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Notes of the Month

JOINT WOOL LEVY PROPOSALS

AUSTRALIAN wool growers have been recommended by the Australian Wool Bureau to accept a proposed amendment to the Wool Tax Act for a joint levy for wool promotion and research. It would simplify collection, said Mr. W. A. Gunn, the Bureau chairman, for the levy would be deducted from wool brokers' account sales, and cover both research and promotion. Wool growers have been asked to consider whether the joint collection should be on a percentage basis, or a rate per bale. Percentage basis provides for a maximum levy of 1½% of the gross proceeds of the clip, and a minimum of 1%. The rate for 1960-61, 1961-62 to be 1% of the gross proceeds. Out of this 1%, £500,000 would be paid to wool research, the balance going to the Wool Use Promotion Fund.

The alternative suggestion provides for a maximum £1 rate per bale (18s. for wool promotion and 2s. for research), and a minimum rate of 12s. per bale. The tax for 1960-61, 1961-62 would be paid at the rate of 12s. per bale—2s. to research and 10s. to promotion.

Mr. Gunn said: "We must increase our wool promotion overseas. To do this and do it well, more money is needed. The Bureau believes that insufficient money spent on promotion is money wasted. Fibres competing with wool for a share of the textile market, have consolidated their position, because almost unlimited funds have been available for promotion and research. The Australian Wool Bureau has increased its overseas wool promotion allocation at a steady rate, but this increase has just kept pace with the inflationary spiral of rising costs, without achieving any significant increase in wool promotion. At no time have sufficient funds been available outside Australia to maintain a continuous hard-hitting advertising campaign. At the present time, wool is only just holding its own. The slightest falling off in demand, the smallest drop in price, would be disastrous, not only to the wool growers, but to the Australian nation."

The current levy of 4s. per bale does not finance Australia's present overseas wool promotion, added Mr. Gunn. A 6s. increase however, would provide a surplus over immediate expenditure. This would convert to a deficit within four years on present planning. The Australian Wool Bureau believes that it is desirable to maintain, and not further deplete, invested funds, because the present return which is the equivalent of 10d. a bale, would have to be provided, if the funds were depleted below their present level.

The current income at 4s. per bale, based on a clip of five million bales, plus the wool stores rental fund is £1,481,000. At 10s. per bale, this amount would increase to £2,980,000. Applying the current rate of levy to the proposed total expenditure, the annual *deficit* and the effect on invested funds is (at 4s. a bale):—

1959-60	1960-61	1961-62	1962-63	1963-64
£A. 363,000	638,750	947,500	1,259,250	1,531,000
Capital Investments				
£A. 3,788,535	3,149,785	2,202,285	943,035	Nil

Mr. Gunn said that expenditure in Australia on promotion and research, would not exceed the 1959-60 allocation. Australia's overseas promotion quota would remain at 62%, the New Zealand and South African Wool Boards contributing the remaining 38%. Total funds for overseas promotion would substantially increase over the next five years.

U.K. COMMENT ON PAKISTAN JUTE POLICY

COMMENTS on raw jute trading with Pakistan were made by Mr. W. Ovenstone, retiring chairman, at the recent annual meeting in Dundee of the Jute Importers' Association. Mr. Ovenstone said that after a long period of price stability it was unfortunate that spinners, weavers and users of jute yarns and goods had been faced once again with a sudden and marked increase in the price of Pakistan jute. Restriction of jute acreage in Pakistan had been followed by a short crop, not only in Pakistan but also in India with the result that prices had soared to the long-term detriment of jute as a packaging medium and in its various other end-uses. With regard to the new crop, there was need for the Pakistan authorities to give an early statement as to their policy. The Association would welcome a considerable relaxation of the three-month limit on forward trading together with a much earlier announcement regarding exporters' licences and minimum prices, if any, for the ensuing season.

Mr. Ovenstone said that proposals for the revision of the Association's contract had been in the hands of the Pakistan Jute Association for more than a year. He hoped that the proposals would receive consideration and agreement at the earliest possible date. Referring to the present investigations into the jute trade now being made by the Pakistan Jute Enquiry Commission, he hoped that this body would agree to send a delegation to Dundee to obtain first-hand information and not restrict the scope of their inquiries to the issue of questionnaires. Mr. Ovenstone added his widely-shared view that the existing method of marketing raw jute was satisfactory and that any alteration, such as the abolition of established marks, would be disastrous.

The new chairman of the Association is Mr. G. C. Stevenson (Ralli Bros. Ltd.). Mr. W. W. Duncan (Jute Industries Ltd.) is vice-chairman.

NEW DEVELOPMENTS IN FABRICS AND FINISHES

THE exhibition featuring rayon fabric developments recently held by the Trade Development Department of Courtaulds Ltd. in their showrooms at 15 Cross Street, Manchester, clearly demonstrated to fabric producers and converters the increased versatility of standard rayon fabrics, and the important part which rayon can play in the production of modern fashion fabrics at prices which place them in the bulk selling categories. Undoubtedly, an important reason for the success of rayon has been the ease in which it can be dyed, printed and finished. There have been important developments in recent years in the finishing of rayon fabrics and further advances will be made in this field in the future. For the exhibition, a wide range of well-established constructions had been processed, in addition to others having a special fashion interest. The fabrics had been prepared in three ways, namely (*a*) wholly filament rayon yarn, (*b*) filament warp with the weft in other fibres, or (*c*) filament weft with the warp in other fibres. The largest proportion of cloths on view had been finished in this country, but other exhibits revealed results produced by Continental finishers. Research and development work by the textile chemist working in close co-operation with the fabric technologist, has made it possible to produce effects which establish rayon as a material with intrinsic properties that allow great scope for the dyer, finisher and printer. The result is an attractive appearance which also meets present day demands for serviceability and usefulness. In addition to the important functional properties, a wide range of decorative effects can be obtained which in many cases give a fabric of standard construction the possibility of a wider variety of end-uses.

Beautifully arranged and divided into seven different sections, one display was of comparative finishes on two all-filament fabrics of 100 den. rayon warp and weft, 88 × 76 ends in the grey. This showed the effect of different finishes on two all-filament fabrics of relatively simple construction. The only difference between the two being that whilst the yarn denier and number of ends were the same, one was made from fine filament and the other coarse filament. The fabrics were arranged in pairs for comparison and demonstrated clearly the versatility of this simple construction in the hands of the finisher. In another section examples were shown here of different finishes applied to a fabric made from 150 den. "Delustra" warp and 30's "Fibro" weft. The finishes demonstrated on one construction showed the finisher's contribution towards an extension of end-uses and variations in handle from soft to firm. The results were of interest to weavers, finishers and merchants. To the weaver: a bulk fabric which had possibilities in wider combinations of warp denier and weft count. To the finisher: a fabric on which "endless changes could be run." To the merchant: the means whereby a basic fabric might be sold in many different markets. A section devoted to the use of rayon in printed dress materials demonstrated many possibilities. Present fashion demands silk-like fabrics easily produced in the classical taffeta and foulard types. The excellent characteristics of rayon meet this trend admirably, used either as warp and weft, or as warp in conjunction with the many kinds of slub wefts now available. Fabrics with surface interest of the rustic variety were shown using a combination of rayon warp and slub and nep weft yarns to give fashion appeal.

An extremely interesting collection of comparative Continental and British finishes gave the technologist, possibly for the first time, an opportunity to compare Dutch, German and British finishes on exactly the same fabrics. The use of rayon in the higher class fashion fabrics was admirably demonstrated and printed examples in this section demonstrated the excellence of rayon as a medium for the application of modern printing techniques and designs. Fabrics incorporating spun dyed "Duracol" yarns were shown in another section. "Duracol" yarns are produced by coloration during manufacture. At present 180 shades are produced and their use is rapidly extending into (to give a few examples) the shirting, washable dress, blouse, pyjama, lining and furnishing fields. One outstanding application of "Duracol" yarns during the past years has been in the "Escorto" shirting range, and an opportunity was taken whilst the exhibition was on to show a few of these excellent fabrics.

nining "Surah" fabrics at the exhibition are (left) Mr. H. C. Foster (Head of tauld Ltd., Trade Development Dept.), and (right) Mr. P. F. Cobbold (Divisional Sales Manager, Courtaulds Ltd., Coventry)

(left) Mr. F. C. Kimmerling of the Trade Development Dept., Courtaulds Ltd., Cove and Mr. R. S. Greenwood of the Fabric Development Dept., Courtaulds Ltd., M chester, look closely at washable "Deltine" finished rainwear with 100% ra filament lining

Slay Eccentricity and its Effect on Weaving

It is especially important to consider the full effects created by the various settings on the fabrics being woven, shuttle flight in relation to crankshaft movement, also shed size and distance travelled by slay before the shuttle enters the shed

By T. RAMSBOTTOM, A.T.I.

THE slay receives eccentric movement to assist the passage of the shuttle through the warp shed. A general statement is that a large sweep and short crank arms will increase the eccentricity of the slay and these are used in wide slow-running looms, whilst in fast-running narrow looms short sweeps and long crank arms are used. There does not appear to be any fixed ruling amongst loom makers on the ideal eccentricity for any particular loom and it was decided to investigate this to ascertain the effect of various settings on the slay's eccentricity. The difficulty in this problem was to find a variety of looms to suit the settings desired but this was overcome by the acquisition of a full-scale model where a variety of settings can be obtained.

Simple Harmonic Motion

First, consider simple harmonic motion. Oscillating movement can be obtained from a crank and a crank can be a disc revolving at the end of a shaft; Fig. 1 shows disc A at the end of a shaft and pin P near its edge. During the revolution of the disc the pin will describe a circle and if the pin operates in the slot of a rod which is set horizontal and can only move in an horizontal plane then the rod will be moved backwards and forwards as the disc revolves. The type of movement given to the rod can be shown by a displacement diagram, where lateral movement of the rod is plotted against angular movement of the pin or against intervals of time. This motion, simple harmonic, may be defined as the movement along the diameter of a circle of a point which moves at constant speed along the circumference. From the displacement diagram it will be seen that the movement is slow as the pin moves from position 12 to 1, then increases from 1 to 2 with a further increase from 2 to 3. In the next 90° the movement decreases in reverse and for the second 180° the movement is identical with that of the first half. Thus the movement of the rod is slow as the pin passes round each side of the circle and fast as the pin passes round the top and bottom of the circle.

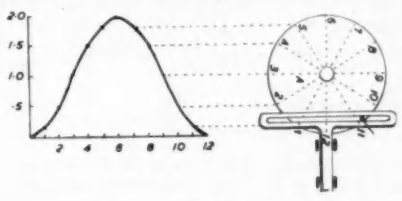


Fig. 1

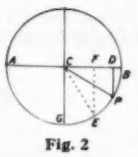


Fig. 2

This can be calculated and Fig. 2 shows the pin P in position 1 thus making an angle of 30° with a horizontal line drawn through the centre. The length CB is 2 ins. and represents half the sweep of the crank. When the pin P has moved through 30° the rod will have moved a distance equal to BD and this can be found as follows:—

CP = 2 ins. Angle PCD = 30°.
∴ CD = cos 30° × CP = 0·8660 × 2 = 1·7320 ins.
CB — CD = 2 ins. — 1·732 ins. = 0·268 ins. which is the movement of the rod.

When pin P has moved through 60° the rod movement will be—

CE = 2 ins. Angle ECF = 60°.
∴ CF = cos 60° × 2 ins. = 0·500 × 2 in. = 1 in.
CB — CF = 2 ins. — 1 in. = 1 in. which is the movement of the rod.

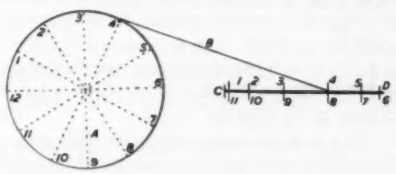
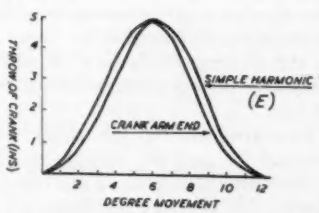


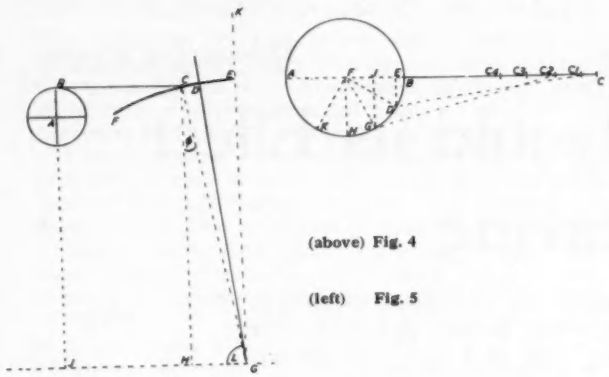
Fig. 3



When the pin has reached position G the angle is 90° and the rod will have moved 2 ins. Thus in the first 30° movement of the crank the rod moved 0·268 ins., in the next 30° it moved 0·732 ins. and in the next 30° 1 in. This movement is reversed whilst the pin travels from G to A and the movement from A to B is similar to that from B to A.

Connecting Rods

In most instances where cranks are employed a connecting rod or arm is used to connect the crank with the part that receives oscillating movement and this movement then departs from the simple harmonic due to the tilting of the arm or rod. In Fig. 3 the circle A is the path taken by a revolving crank of 5 ins. sweep with a connecting arm B. As the crank revolves the end of the connecting arm movement is plotted for each 30° movement of the crank. The movement from C to D represents the throw of the crank



(above) Fig. 4

(left) Fig. 5

and as the crank moves from position 12 to position 1 (i.e. 30) the movement of the connecting arm end is slow, with an increase in movement for the next 30° crank movement (position 1 to 2) a further increase in movement for the next 30° crank movement (position 2 to 3) and a further increase in movement from position 3 to position 4.

In the first 90° movement of the crank the connecting arm end will have moved less than half the throw due to the tilting of the arm from the horizontal position, thus reducing its effective length. In the next 90° movement from position 3 to 6, the connecting arm end will move more than half the throw due to the tilted crank arm again approaching the horizontal position and its effective length increasing. The greatest movement of the connecting arm end for any 30° movement of the crank, is from position 3 to 4 and this then decreases from 4 to 5 and further decreases from 5 to 6. The return half of the crank movement from 6 to 12 reverses the movement of the connecting rod end in a similar manner. If a displacement curve of this movement is plotted and superimposed on that of simple harmonic, it will be seen that the two displacement curves differ as shown at E, Fig. 3.

This movement is similar to that employed on the loom slay and if position 6 represents front centre position of the loom, the slay would move back quickly as the crank rotates to bottom centre (position 9). From bottom to back centre (12) the slay movement is slow and this is important, for during this period the shuttle will be travelling across the slay.

The movement of the connecting arm end may be calculated for each 30° movement of the crank. In Fig. 4 the crank sweep of 5 ins. is represented by the circle with a diameter AB equal to the sweep of the crank. The connecting arm BC is 10 ins. long and the movement of the crank is taken from front centre B when the connecting arm is horizontal. In the first 30° movement the arm will be in the position DC1. This tilting reduces its effective length and in turn affects the movement of the connecting arm end.

First 30° Movement of Crank

DF = 2·5 ins. and angle DFE = 30°.
The length of FE = cos 30° × DF = 0·866 × 2·5 = 2·165 ins.
∴ Crank has moved laterally 2·5 — 2·165 = 0·335 ins.
The effective length of the connecting arm can be found as follows:—
DE = tan. 30° × 2·165 = 0·5774 × 2·165 = 1·25 ins.

The angle made by the connecting arm with the horizontal position will equal

$$\frac{DE}{DC1} = \text{sine} = \frac{1{\cdot}25}{10} = 0{\cdot}125 = 7° 11'$$

∴ effective length of connecting arm will equal
Cos 7° 11′ × DC1 = 0·9921 × 10 = 9·921 ins. This represents a decrease of 10 — 9·921 = 0·079 ins. Therefore, total movement of connecting arm end will be 0·335 + 0·079 = 0·414 ins.

60° Movement of Crankshaft

FG = 2·5 ins. Angle GFJ = 60°.
FJ = cos 60° × FG = 0·5 × 2·5 = 1·25 ins.
∴ Crank has moved laterally 2·5 — 1·25 = 1·25 ins.
Effective length of connecting arm = GJ = tan 60° × 1·25 = 1·7321 × 1·25 = 2·165 ins.
Angle made by connecting arm—

$$\frac{GJ}{GC2} = \text{sine} = \frac{2{\cdot}165}{10} = 0{\cdot}2165 = 12° 30'.$$

Cos 12° 30′ × GC2 = 0·9763 × 10 = 9·763 ins. a difference of 0·237 ins.
∴ Total movement of connecting arm end from C to C2 = 1·25 + 0·237 = 1·487 ins.

90° Movement of Crank

The crank, now at bottom centre, will have moved laterally 2·5 ins.

HF = 2·5 ins. Angle made by connecting arm $= \frac{HF}{HC3} = \text{sine} = \frac{2{\cdot}5}{10}$
= 0·25 = 14° 29′. Cos 14° 29′ × HC3 = 0·9682 × 10 = 9·682 ins., a difference of 10 — 9·682 = 0·318 ins.
∴ Total movement of connecting arm end from C to C3 = 2·5 + 0·318 = 2·818 ins.

In the first 90° movement of the crankshaft from front to bottom centre the connecting arm end will have moved laterally 2·818 ins. The full sweep of the crank is 5 ins. so that in the next 90° movement from bottom to back centre the connecting arm end will only move laterally 5 — 2·818 = 2·182 ins. as shown by the following: Starting at bottom centre, in the next 30° the crank will move laterally 1·25 ins. but the connecting arm angle is less as it approaches the horizontal position. Therefore, the effective length of the arm will increase from 9·682 to 9·763 ins., a difference of 0·081 ins. The connecting arm end will thus move laterally 1·25 — 0·081 = 1·169 ins. In the next 30° the crank will move laterally 1·25 — 0·335 = 0·915 ins., but the connecting arm effective length will have further increased from 9·763 to 9·921 ins., a difference of 0·158 ins., so that the connecting arm end will move 0·915 — 0·158 = 0·757 in. In the next 30° movement the crank will move laterally 0·335 ins., and the effective length of the connecting arm will increase from 9·921 to 10 ins., a difference of 0·079 ins. Therefore connecting arm end will move 0·335 — 0·079 = 0·256 ins.

Thus for the 3 × 30° movements from bottom to back centre the connecting arm end will have movements of:—

First	30°	=	1·169 ins.
Second	„	=	0·757 „
Third	„	=	0.256 „
	Total movement	=	2·182 ins.

From back centre continuing the rotation, the connecting arm end will be moving to the right back to original starting position. From back to top centre the lateral movement of the crank will be decreased in effective movement at the connecting arm end by the effect of the crank arm tilting and its effective length decreasing. Thus the movement of the connecting arm end from back to top centre will be the reverse of that from bottom to back centre and the connecting arm end will again only move 2·182 ins. The movement from top to front centre will be the reverse of that from front to bottom since the arm is again approaching horizontal and its effective length will increase. The movement therefore of the arm end for each 90° of a complete revolution starting at front centre will be:—

Front to bottom centre	=	2·818 ins.
Bottom to back centre	=	2·182 „
Back to top centre	=	2·182 „
Top to front centre	=	2·818 „

The difference in movement from front to bottom and bottom to back centre = 2·818 — 2·182 = 0·736 ins. which calculated as a percentage of the total movement = 14·72%.

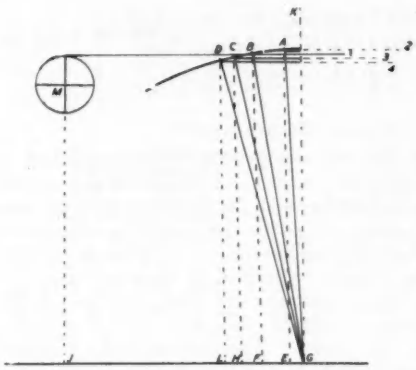


Fig. 6

Normal Setting

For most narrow and medium width looms the crank arm is horizontal with the crank at top centre. In Fig. 5 a crank sweep of 5 ins. is represented by the circle with the centre of the crankshaft at A. Crank arm BC is 14·75 ins. long and the sword pin C 3·25 ins. behind the reed and 2 ins. below it. The sword moves on fulcrum G and the line GK represents the position of the reed at front centre. The sword pin C will move in the arc represented by EF and will have a radius of 27·5 ins. the distance from C to G. Line AJ is drawn from the centre of the crankshaft to meet the horizontal line and the distance from J to G is 20·25 ins.

This will be referred to as the normal setting and it is intended to measure the distance horizontally the slay sword pin moves from the perpendicular GK, for a given movement of the crank. The sword pin moving in an arc varies in perpendicular distance from the horizontal JG. The angle L at top centre also varies according to the length of the crank arm, size of sweep and position of crankshaft and sword pin. However, as the variations for the settings investigated are small it will be assumed that for settings 1 to 3 the sword pin will occupy this position at top centre. The perpendicular distance CH can then be calculated thus:—

$$20{\cdot}25 - 14{\cdot}75 = 5{\cdot}5 \text{ ins. length of HG.}$$

$$\therefore \frac{HG}{CG} = \sin \angle = \frac{5{\cdot}5}{27{\cdot}5} = 0{\cdot}2 = 11^\circ\ 33'.$$

$$\text{Cos } 11^\circ\ 33' \times 27{\cdot}5 = HC = 0{\cdot}9797 \times 27{\cdot}5 = 26{\cdot}94 \text{ ins.}$$

This, referred to as horizontal zero position 1, represents a horizontal line drawn from the top of the crank sweep through the sword pin. The perpendicular distances the sword pin will occupy at front bottom and back centres can also be calculated and Fig. 6 clarifies this. With the crank arm at front centre the reed will be in a vertical position at GK and the sword pin will be 3·25 ins. behind the reed in position A. Thus the perpendicular distance AE is calculated as follows:—

$$\frac{3{\cdot}25}{27{\cdot}5} = \sin = 0{\cdot}1181 = 6^\circ\ 47'.$$

$$\text{Cos } 6^\circ\ 47' \times 27{\cdot}5 = 0{\cdot}9930 \times 27{\cdot}5 = 27{\cdot}3 \text{ ins.}$$

This is referred to as horizontal position 2. The position of the sword pin at bottom centre varies according to the eccentricity but it is reasonable to assume that the pin will have moved horizontally a distance of approximately 3 ins. from front to bottom centre. On this assumption the perpendicular distance CH is calculated.

$$\frac{6{\cdot}25}{27{\cdot}5} = \sin = 0{\cdot}2272 = 13^\circ\ 8'.$$

$$\text{Cos } 13^\circ\ 8' \times CG = 0{\cdot}9739 \times 27{\cdot}5 = 26{\cdot}76 \text{ ins.}$$

This will be referred to as horizontal position 3.

At back centre the sword pin is in its lowest position at D and the perpendicular distance DL can be calculated.

$$\frac{8{\cdot}25}{27{\cdot}5} = \sin = 0{\cdot}3 = 17^\circ\ 28'.$$

$$\text{Cos } 17^\circ\ 28' \times DG = 0{\cdot}9539 \times 27{\cdot}5 = 26{\cdot}2 \text{ ins.}$$

This will be referred to as horizontal position 4.

The difference between horizontal position 1 and 2 = 0·36 in. At 3 the sword pin will be 0·18 in. below 1 and at 4 it will be 0·74 in. below 1. The movement of the sword pin will be calculated along these horizontal positions when the crank is at front, bottom, back and top centres. The horizontal positions vary with the different settings but the amount of error will be correspondingly small. However, some slight variation is expected when the calculated movement is compared with the actual movement.

Sword Pin Movement for Normal Setting

Setting No. 1.—Starting the crank movement at front centre the crank arm will be at an angle with the horizontal position 2 and as the crank moves to bottom centre this angle will be increasing due to the tilting of the crank arm and the effective length of the crank arm will be decreasing. This decrease in effective length will have the effect of increasing the sword pin movement as it is displaced from front centre. From bottom to back centre the crank arm angle will be decreasing and its effective length increasing thus the sword pin movement will decrease as it is displaced from bottom centre. From back to top centre the crank arm will be approaching the horizontal and its effective length still increasing. The sword pin is now moving forwards and the effective length increase of the crank arm will cause the pin movement to increase as it is displaced from back centre. From top to front centre the crank arm is again tilting and its effective length will decrease; the sword pin movement will therefore decrease as it is displaced from top centre. The movement given to the sword pin as it moves from front, bottom, back and top centres is calculated as follows:—

Effective length of crank arm at top centre = 14·75 ins.

$$\text{Effective length of crank arm at front centre} = \frac{2{\cdot}86}{14{\cdot}75} = \sin = 0{\cdot}1939$$

$$= 11^\circ\ 11'.$$

$$\text{Cos } 11^\circ\ 11' \times 14{\cdot}75 = 0{\cdot}9810 \times 14{\cdot}75 = 14{\cdot}47 \text{ ins.}$$

$$\text{Effective length of crank arm at bottom centre} = \frac{4{\cdot}82}{14{\cdot}75} = \sin = 0{\cdot}3267$$

$$= 19^\circ\ 4'.$$

$$\text{Cos } 19^\circ\ 4' \times 14{\cdot}75 = 0{\cdot}9451 \times 14{\cdot}75 = 13{\cdot}94 \text{ ins.}$$

$$\text{Effective length of crank arm at back centre} = \frac{1{\cdot}76}{14{\cdot}75} = \sin = 0{\cdot}1193$$

$$= 6^\circ\ 51'.$$

$$\text{Cos } 6^\circ\ 51' \times 14{\cdot}75 = 0{\cdot}9929 \times 14{\cdot}75 = 14{\cdot}65 \text{ ins.}$$

Difference in Effective Length

Front to bottom centre	=	0·53 ins.
Bottom to back centre	=	0·71 ,,
Back to top centre	=	0·1 ,,
Top to front centre	=	0·28 ,,

Sword Pin Movement

Front to bottom centre	=	2·5 + 0·53 = 3·03 ins.
Bottom to back centre	=	2·5 — 0·71 = 1·79 ,,
Back to top centre	=	2·5 + 0·1 = 2·6 ,,
Top to front centre	=	2·5 — 0·28 = 2·22 ,,
Total horizontal movement of sword pin	=	4·82 ins.

It will be appreciated that in calculating the horizontal positions a 5-in. movement of the slay sword pin was allowed. This will not be so in actual horizontal measurement and will vary with the different settings, the error however is so small as to be insignificant.

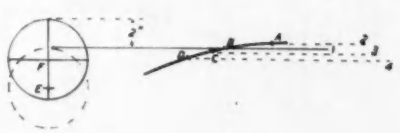


Fig. 7

Setting No. 2.—In this setting the centre of the crankshaft was moved up by 2 ins. and is shown in Fig. 7. All other settings were the same but it was found that in order to get the reed in the perpendicular position at front centre the crank arm had to be shortened in length. The effective length of the crank arm at front centre must be 14·47 ins. in order to give the perpendicular position to the reed.

$$\therefore \text{ Length of crank arm must be } \frac{0{\cdot}86}{14{\cdot}47} = \tan = 0{\cdot}0594 = 3^\circ\ 24'.$$

$$\frac{14{\cdot}47}{\text{Cos } 3^\circ\ 24'} = \frac{14{\cdot}47}{0{\cdot}9982} = 14{\cdot}5 \text{ ins.}$$

$$\text{Effective length of crank arm at bottom centre} = \frac{2{\cdot}82}{14{\cdot}5} = \text{sine} = 0{\cdot}1944$$

$$= 11^\circ\ 13'.$$

$$\text{Cos } 11^\circ\ 13' \times 14{\cdot}5 = 0{\cdot}9809 = 14{\cdot}2 \text{ ins.}$$

$$\text{Effective length of crank arm at back centre} = \frac{0{\cdot}24}{14{\cdot}5} = \text{sine} = 0{\cdot}0165$$

$$= 0^\circ\ 57'.$$

$$\text{Cos } 0^\circ\ 57' \times 14{\cdot}5 = 0{\cdot}9999 \times 14{\cdot}5 = 14{\cdot}5 \text{ ins.}$$

$$\text{Effective length of crank arm at top centre} = \frac{2{\cdot}0}{14{\cdot}5} = \text{sine} = 0{\cdot}1379$$

$$= 7^\circ\ 56'.$$

$$\text{Cos } 7^\circ\ 56' \times 14{\cdot}5 = 0{\cdot}9904 \times 14{\cdot}5 = 14{\cdot}36 \text{ ins.}$$

Difference in Effective Length

Front to bottom centre	=	0·27 ins.
Bottom to back centre	=	0·3 "
Back to top centre	=	0·14 "
Top to front centre	=	0·11 "

Sword Pin Movement

Front to bottom centre	=	2·5 + 0·27	= 2·77 ins.
Bottom to back centre	=	2·5 — 0·3	= 2·2 "
Back to top centre	=	2·5 — 0·14	= 2·36 "
Top to front centre	=	2·5 + 0·11	= 2·61 "
Total horizontal movement of sword pin	=		4·97 ins.

Setting No. 3.—In this setting (Fig. 8) the crankshaft centre was moved to 2 ins. below the normal setting. This again necessitated an adjustment to the length of the crank arm in order to get the perpendicular zero setting at front centre.

$$\text{Effective length of crank arm at front centre} = 14{\cdot}47 \text{ ins.}$$

$$\therefore \text{ Length of crank arm to give the perpendicular zero setting} = \frac{4{\cdot}86}{14{\cdot}47} = \tan = 0{\cdot}3358 = 18^\circ\ 34'.$$

$$\frac{14{\cdot}47}{\text{Cos } 18^\circ\ 34'} = \frac{14{\cdot}47}{0{\cdot}9479} = 15{\cdot}26 \text{ ins.}$$

$$\text{Effective length of crank arm at bottom centre} = \frac{6{\cdot}82}{15{\cdot}26} = \text{sine} = 0{\cdot}4469$$

$$= 26^\circ\ 33'.$$

$$\text{Cos } 26^\circ\ 33' \times 15{\cdot}26 = 0{\cdot}8945 \times 15{\cdot}26 = 13{\cdot}65 \text{ ins.}$$

$$\text{Effective length of crank arm at back centre} = \frac{3{\cdot}76}{15{\cdot}26} = \text{sine} = 0{\cdot}2464$$

$$= 14^\circ\ 16'.$$

$$\text{Cos } 14^\circ\ 16' \times 15{\cdot}26 = 0{\cdot}9691 \times 15{\cdot}26 = 14{\cdot}79 \text{ ins.}$$

$$\text{Effective length of crank arm at top centre} = \frac{2{\cdot}0}{15{\cdot}26} = \text{sine} = 0{\cdot}1310$$

$$= 7^\circ\ 32'.$$

$$\text{Cos } 7^\circ\ 32' \times 15{\cdot}26 = 0{\cdot}9913 \times 15{\cdot}26 = 15{\cdot}13 \text{ in.}$$

Difference in Effective Length

Front to bottom centre	=	0·82 ins.
Bottom to back centre	=	1·14 "
Back to top centre	=	0·34 "
Top to front centre	=	0·66 "

Sword Pin Movement

Front to bottom centre	=	2·5 + 0·82	= 3·32 ins.
Bottom to back centre	=	2·5 — 1·14	= 1·36 "
Back to top centre	=	2·5 + 0·34	= 2·84 "
Top to front centre	=	2·5 — 0·66	= 1·84 "
Total horizontal movement of sword pin	=		4·68 ins.

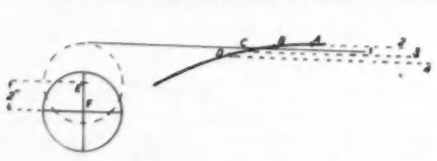


Fig. 8

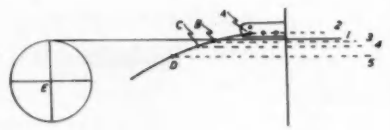


Fig. 9

Setting No. 4.—In this setting (Fig. 9) the crankshaft is moved back to original position and the sword pin moved back to 7·75 ins. behind the reed. To give the perpendicular setting at front centre the crank arm length is reduced to 10·4 ins. Due to the increase in the length of the slay sword ears (i.e. 7·75 ins.) the arc described by the sword pin will differ from the normal setting. Therefore, new horizontal positions have been calculated when the crank is at front, top, bottom and back centres. The zero position 1 remains the same and corresponds to a horizontal line drawn from the top centre of the crank sweep. The distance from the sword pin to the fulcrum of the sword will now be 28·4 ins. and the horizontal positions have been calculated as follows:—

At front centre, the sword pin is in its highest position and the perpendicular distance will be:—

$$\frac{7{\cdot}75}{28{\cdot}4} = \text{sine} = 0{\cdot}2728 = 15^\circ\ 50'.$$

$$\text{Cos } 15^\circ\ 50' \times 28{\cdot}4 = 0{\cdot}962 \times 28{\cdot}4 = 27{\cdot}3 \text{ ins.}$$

This is similar to the previous settings being 0·36 in. above zero position 1 and will be referred to as horizontal position 2.

When the crank is at top centre the horizontal position of the sword pin will be:—

$$20{\cdot}25 \text{ ins.} - 10{\cdot}4 = 9{\cdot}85 \text{ ins.}$$

$$\therefore \frac{9{\cdot}85}{28{\cdot}4} = \text{sine} = 0{\cdot}3433 = 20^\circ\ 10'.$$

$$\text{Cos } 20^\circ\ 10' \times 28{\cdot}4 = 0{\cdot}9387 \times 28{\cdot}4 = 26{\cdot}68 \text{ ins.}$$

This will be referred to as horizontal position 3 and will be 0·26 in. below 1.

With the crank at back centre the horizontal position of the sword pin will be:—

$$\frac{12{\cdot}75}{28{\cdot}4} = \text{sine} = 0{\cdot}4489 = 26^\circ\ 40'.$$

$$\text{Cos } 26^\circ\ 40' \times 28{\cdot}4 = 0{\cdot}8937 \times 28{\cdot}4 = 25{\cdot}3 \text{ ins.}$$

This will be referred to as horizontal position 5 and is the lowest position the sword pin will occupy, being 1·64 ins. below horizontal zero position 1.

When the crank is at bottom centre it is assumed the sword pin will have moved back horizontally half the sweep. On this assumption the horizontal position is calculated thus:—

$$\frac{10{\cdot}25}{28{\cdot}4} = \text{sine} = 0{\cdot}3609 = 21^\circ\ 9'.$$

$$\text{Cos } 21^\circ\ 9' \times 28{\cdot}4 = 0{\cdot}9327 \times 28{\cdot}4 = 26{\cdot}48 \text{ ins.}$$

This, referred to as horizontal position 4, will be 0·46 in. below position 1.

The effective length of the crank arm at top, front, bottom and back centres can now be calculated. The crank arm is in the horizontal position at top centre and its effective length will be the same as the length of the crank arm, namely 10·4 ins.

$$\text{Effective length of crank arm at front centre} = \frac{2{\cdot}86}{10{\cdot}4} = 0{\cdot}275$$

$$= 15^\circ\ 58'.$$

$$\text{Cos } 15^\circ\ 58' \times 10{\cdot}4 = 0{\cdot}9614 \times 10{\cdot}4 = 9{\cdot}99 \text{ ins.}$$

$$\text{Effective length of crank arm at bottom centre} = \frac{4{\cdot}54}{10{\cdot}4} = \text{sine} = 0{\cdot}4365$$

$$= 25^\circ\ 53'.$$

$$\text{Cos } 25^\circ\ 53' \times 10{\cdot}4 = 0{\cdot}8997 \times 10{\cdot}4 = 9{\cdot}36 \text{ ins.}$$

$$\text{Effective length of crank arm at back centre} = \frac{0{\cdot}86}{10{\cdot}4} = \text{sine} = 0{\cdot}0827$$

$$= 4^\circ\ 45'.$$

$$\text{Cos } 4^\circ\ 45' \times 10{\cdot}4 = 0{\cdot}9966 \times 10{\cdot}4 = 10{\cdot}36 \text{ ins.}$$

Difference in Effective Length

Front to bottom centre = 0·63 in.
Bottom to back centre = 1·0 „
Back to top centre = 0·04 „
Top to front centre = 0·41 „

Sword Pin Movement

Front to bottom centre = 2·5 + 0·63 = 3·13 ins.
Bottom to back centre = 2·5 — 1·0 = 1·5 „
Back to top centre = 2·5 + 0·04 = 2.54 „
Top to front centre = 2·5 — 0·41 = 2·09 „
Total horizontal movement of slay sword pin = 4·63 ins.

Setting No. 5.—In this setting (Fig. 10) the slay sword pin is still 7·75 ins., behind the reed but it has been moved up 1·25 ins. The arc described by the pin will be parallel to that in setting 4 but the horizontal positions will be 1·25 ins. higher. The effective length of the crank arm at front centre will be 10 ins., and so the crank arm length will be:—

$$\frac{4\cdot11}{10} = \tan = 0\cdot411 = 22^\circ\ 21'.$$

$$\therefore \frac{10}{\text{Cos } 22^\circ\ 21'} = \frac{10}{0\cdot9249} = 10\cdot8 \text{ ins.}$$

Effective length of crank arm at bottom centre $= \frac{5\cdot79}{10\cdot8} = \text{sine} = 0\cdot5324$
$= 32^\circ\ 10'.$
Cos $32^\circ\ 10' \times 10\cdot8 = 0\cdot8465 \times 10\cdot8 = 9\cdot14$ ins.

Effective length of crank arm at back centre $= \frac{2\cdot11}{10\cdot8} = \text{sine} = 0\cdot1953$
$= 11^\circ\ 16'.$
Cos $11^\circ\ 16' \times 10\cdot8 = 0\cdot9807 \times 10\cdot8 = 10\cdot59$ ins.

Effective length of crank arm at top centre $= \frac{0\cdot99}{10\cdot8} = \text{sine} = 0\cdot0916$
$= 5^\circ\ 15'.$
Cos $5^\circ\ 15' \times 10\cdot8 = 0\cdot9958 \times 10\cdot8 = 10\cdot75$ ins.

Difference in Effective Length

Front to bottom centre = 0·86 ins.
Bottom to back centre = 1·45 „
Back to top centre = 0·16 „
Top to front centre = 0·75 „

Sword Pin Movement

Front to bottom centre = 2·5 + 0·86 = 3·36 ins.
Bottom to back centre = 2·5 — 1·45 = 1·05 „
Back to top centre = 2·5 + 0·16 = 2·66 „
Top to front centre = 2·5 — 0·75 = 1·75 „
Total horizontal movement of slay sword pin = 4·41 ins.

Setting No. 6.—For this setting (Fig. 11) the crank sweep has been increased to 7 ins. with an adjustment to the length of the crank arm. For this 7 ins. sweep the arc described by the sword pin will be longer and the horizontal positions different. The sword pin is in its original position.

Horizontal zero position 1 = 26·94 ins.
Horizontal position 2 (crank at front centre) = 27·3 ins.

When the crank is at top centre, approximately half sweep, the position of the sword pin will be:—

$$\frac{6\cdot75}{27\cdot5} = \text{sine} = 0\cdot2434 = 14^\circ\ 12'.$$

Cos $14^\circ\ 12' \times 27\cdot5 = 0\cdot9694 \times 27\cdot5 = 26\cdot65$ ins.

This is referred to as horizontal position 3.

When the crank is at bottom centre it is assumed the sword pin is 0·2 in. below that of top centre position and its horizontal position will be 26·45 ins.

This is referred to as horizontal position 4.

When the crank is at back centre the horizontal position of the sword pin will be:—

$$\frac{10\cdot25}{27\cdot5} = \text{sine} = 0\cdot3727 = 21^\circ\ 53'.$$

Cos $21^\circ\ 53' \times 27\cdot5 = 0\cdot9279 \times 27\cdot5 = 25\cdot5$ ins.

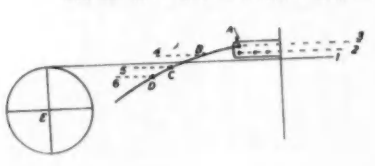


Fig. 10

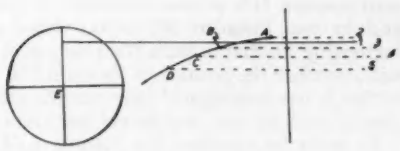


Fig. 11

This is referred to as horizontal position 5.

The variations in the horizontal positions are thus:—

Horizontal position 1 = 26·94 ins.
„ „ 2 (front centre) = 27·3 ins. = 0·36 above pos. 1.
„ „ 3 (top centre) = 26·65 „ = 0·29 below pos. 1.
„ „ 4 (bottom centre) = 26·45 „ = 0·49 below pos. 1.
„ „ 5 (back centre) = 25·5 „ = 1·44 below pos. 1.
Effective length of the crank arm at front centre = 13·5 ins.

Crank arm length will be:— $\frac{2\cdot96}{13\cdot5} = \tan = 0\cdot2148 = 12^\circ\ 7'.$

$$\frac{13\cdot5}{\text{Cos } 12^\circ\ 7'} = \frac{13\cdot5}{0\cdot9777} = 13\cdot8 \text{ ins.}$$

Effective length of crank arm at bottom centre $= \frac{5\cdot51}{13\cdot8} = \text{sine} = 0\cdot3992$
$= 23^\circ\ 32'.$ Cos $23^\circ\ 32' \times 13\cdot8 = 0\cdot9169 \times 13\cdot8 = 12\cdot65$ ins.

Effective length of crank arm at back centre $= \frac{1\cdot06}{13\cdot8} = \text{sine} = 0\cdot0768$
$= 4^\circ\ 24'.$ Cos $4^\circ\ 24' \times 13\cdot8 = 0\cdot9971 \times 13\cdot8 = 13\cdot76$ ins.

Effective length of crank arm at top centre $= \frac{1.29}{13\cdot8} = \text{sine} = 0\cdot0934$
$= 5^\circ\ 22'.$ Cos $5^\circ\ 22' \times 13\cdot8 = 0\cdot9956 \times 13\cdot8 = 13\cdot74$ ins.

Difference in Effective Length

Front to bottom centre = 0·85 ins.
Bottom to back centre = 1·11 „
Back to top centre = 0·02 „
Top to front centre = 0·24 „

Sword Pin Movement

Front to bottom centre = 3·5 + 0·85 = 4·35 ins.
Bottom to back centre = 3·5 — 1·11 = 2·39 „
Back to top centre = 3·5 — 0.02 = 3·48 „
Top to front centre = 3·5 — 0·24 = 3·26 „
Total horizontal movement of sword pin = 6·74 ins.

Comparisons

It was now decided to compare these calculations with the actual measurements taken with these various settings. The full scale model available was set in turn with the dimensions corresponding to each setting and the horizontal displacement of the reed taken for each 15° movement of the crankshaft. The front centre was taken as zero in each case and the recorded results are shown in Table 1.

An interesting feature of these recordings is that in settings 3, 4 and 5 the reed was in front of the perpendicular

Table 1

Setting No.	1	2	3	4	5	6
Sweep	5 ins.	5 ins.	5 ins.	5 ins.	5 ins.	7 ins.
Reed above Pin	2 „	2 „	2 „	2 „	0·75 „	2 „
Pin to Fulcrum	27·5 „	27·5 „	27·5 „	28·4 „	29·6 „	27·5 „
Pin from Reed	3·25 „	3·25 „	3·25 „	7·75 „	7·75 „	3·25 „
Crankshaft	normal	2 ins. up	2 ins. down	normal	normal	normal
Length of Arm	14·75 ins.	14·5 ins.	15·26 ins.	10·5 ins.	10·9 ins.	13·8 ins.
degrees	ins.	ins.	ins.	ins.	ins.	ins.
0	0	0	0	0	0	0
15	0·2	0·1	0·2	0·5	0·3	0·4
30	0·6	0·4	0·7	1·1	0·8	1·0
45	1·1	0·9	1·3	1·7	1·4	1·8
60	1·8	1·5	2·0	2·4	2·0	2·8
75	2·6	2·2	2·7	3·0	2·7	3·8
90	3·3	2·9	3·6	3·4	3·5	4·7
105	3·8	3·5	4·0	3·8	3·9	5·5
120	4·3	4·2	4·4	4·3	4·3	6·3
135	4·7	4·7	4·8	4·7	4·5	6·8
150	5·0	5·0	5·1	4·9	4·6	7·2
165	5·2	5·3	5·2	5·0	4·6	7·3
180	5·2	5·3	5·1	5·0	4·6	7·3
195	5·1	5·3	4·8	4·9	4·5	7·1
210	4·8	5·1	4·4	4·6	4·1	6·8
225	4·4	4·7	3·9	4·1	3·6	6·2
240	3·8	4·1	3·3	3·6	3·0	5·4
255	3·2	3·5	2·7	2·9	2·4	4·4
270	2·4	2·8	2·0	2·2	1·8	3·5
285	1·8	2·0	1·6	1·5	1·1	2·5
300	1·2	1·4	0·9	0·8	0·6	1·6
315	0·7	0·8	0·3	0·4	0·1	0·8
330	0·3	0·4	0·0	0·0	+ 0·1	0·3
345	0·1	0·1	+ 0·1	+ 0·1	+ 0·1	0·0
360	0	0	0	0	0	0

zero position GK in two instances 15° before front centre and in one instance 30° before front centre. This is interesting, in that it alters the position of the beat-up and will also affect the position of the cloth fell. The significance of this is not investigated here but the effect on cover and size of shed are just two points that come to mind.

In order to compare the results in Table 1 with the calculations it was necessary to bring them both to the same medium, for the practical measurements show the reed displacement whilst the calculations show the sword pin displacement. The calculations have therefore been adjusted to reed displacement and these—set out in Table 2—show the calculated reed displacement in comparison with the actual measurements.

The difference in displacement from front to bottom centre and bottom to back centre are also shown and these have been calculated as a percentage of the actual sweep in both cases. The calculated results compare very favourably with the actual measurements taken and the table shows the effect of the various settings.

With the connecting arm in a horizontal position at front centre (Fig. 4), the percentage of eccentricity or the difference in slay sword pin movement from front to bottom and bottom to back centre was 14·72%. In setting No. 1 this percentage was increased by having the crank arm horizontal at top centre position. In setting No. 2 this percentage was decreased by raising the position of the crankshaft; this particular setting closely resembles that in Fig. 4. The effect of lowering the crankshaft 2 ins. from normal position increased considerably the eccentricity as shown in setting No. 3. An increase in eccentricity was also achieved by increasing the length of the sword ears as in setting No. 4, although this was not as great as the effect of lowering the crankshaft as in setting No. 3. However, altering of the sword pin position as in setting No. 5 along with the increase in sword ear length further increased the eccentricity. Increasing the crank sweep and shortening of crank arm also increased the eccentricity but not to the same degree as some of the other settings. It is interesting to note that as the eccentricity of the slay is increased, the horizontal movement is decreased but not in any significant proportion. In settings Nos. 4 and 5 where the length of the sword ears was increased, the effect on the horizontal displacement of the slay is most effective. Although the eccentricity in setting No. 4 is less than that of setting No. 3, the horizontal displacement of the slay is also less.

With the exception of setting No. 2 the movement of the slay from back to top centre is greater than from top to front centre. It is intended later to show the length of time in which the shuttle is travelling across the slay and to note if this quick movement from back to top centre is of any great significance. The slower movement of the slay in the majority of settings from top to front centre will tend to give a slow movement to the slay at beat-up and will thus have the effect of pushing the pick of weft into the fell of the cloth rather than hammering it in.

Further to this investigation it was now decided to take the measurements of the sword displacement on a loom and to correlate this movement with the actual traverse of the shuttle across the slay. A loom was chosen at random and the following measurements noted:—

Crank sweep 5 ins. Length of crank arm 10·5 ins. Reed 2 ins. above slay sword pin. Distance from pin to fulcrum 27·5 ins. Distance from pin to reed 3·25 ins. Crank shaft 1 in. above normal setting.

Horizontal Displacement of Reed from Front Centre zero Setting	
Degrees	Inches
0	0
30	0·5
60	1·8
90	3·3
120	4·3
150	5·1
180	5·2
210	4·9
240	3·8
270	2·4
300	1·1
330	0·2
360	0·0

The difference in movement between front and bottom centre and bottom and back centre = 3·3 — 1·9 = 1·4 ins. which is 26·9% of the total slay movement. The difference in movement between back and top centre and top and front centre = 2·8 — 2·4 = 0·4 in. which is 7·7% of the total slay movement. This eccentricity is similar to setting No. 1 and, whereas in that setting the crank arm was horizontal at top centre, in this case the crankshaft is 1 in. above normal which should mean a reduction in eccentricity. However the effect of the shorter crank arm is here emphasised by the increase in eccentricity over that of setting No. 2.

The reed width of the loom was 36 ins. and the following timings were taken with the front centre as zero:—

Shedding 260°.	Picking commenced 75°.
Healds fully open 80°.	Shuttle entering race board 90°.
Healds beginning to close 180°.	Picks/min. 170.

It was now necessary to ascertain the time in degrees the shuttle was traversing across the race board. This was done first, by means of the "Shirley" "M" gauge and then verified by means of the "Stroboloom." The "M" gauge reading was 7·25 ins. and the degrees of shuttle flight were calculated as follows:—

$$\text{Shuttle speed} = \frac{7{\cdot}25 \times 170}{39} = 31{\cdot}6 \text{ ft./sec.}$$

$$\frac{S}{V} = t. \quad \therefore \quad \frac{3}{31{\cdot}6} = 0{\cdot}0949 \text{ secs. for shuttle flight.}$$

$$\text{Seconds for each pick} = \frac{60}{170} = 0{\cdot}353 \text{ secs.}$$

$$\therefore \frac{0{\cdot}353 \times \text{Crank degree movement for shuttle flight}}{360} = 0{\cdot}0949$$

$$\text{and} \quad \frac{0{\cdot}0949 \times 360}{0{\cdot}353} = \text{crank deg. movement for shuttle flight} = 96{\cdot}7°$$

The "Stroboloom" reading gave 94° which means a slightly higher shuttle speed, but as the loom was empty when the "Stroboloom" reading was taken it was assumed that this difference was due to the absence of the retardation effect of the warp sheet and that the "M" gauge reading was more correct. From these observations the shuttle was entering the race board at 90° from front centre and leaving the race board at approximately 187° from front centre. This means that from approximately bottom to back centre is occupied by shuttle flight and the slay movement in this period is slowest, in this case moving horizontally a distance of 1·9 ins. The timing of the picking in this case is rather on the early side, and later picking would mean that the

Table 2

Crank Movement	Setting 1		Setting 2		Setting 3		Setting 4		Setting 5		Setting 6	
	Cal.	Act.	Cal.	Act.	Cal.	Act.	Cal.	Act.	Cal.	Act.	Cal.	Act.
(A) From front to bottom centre	3·25	3·3	2·97	2·9	3·56	3·6	3·36	3·4	3·6	3·5	4·69	4·7
(B) Bottom to back centre	1·92	1·9	2·36	2·4	1·46	1·5	1·62	1·6	1·13	1·1	2·54	2·6
(C) Back to top centre	2·78	2·8	2·55	2·5	3·0	3·1	2·72	2·8	2·85	2·8	3·73	3·8
(D) Top to front centre	2·38	2·4	2·8	2·8	1·94	2·0	2·24	2·2	1·87	1·8	3·5	3·5
Difference between (A) and (B)	1·33	1·4	0·61	0·5	2·1	2·1	1·74	1·8	2·47	2·4	2·15	2·1
Difference between (C) and (D)	0·5	0·4	0·25	0·3	1·06	1·1	0·48	0·6	0·98	1·0	0·23	0·3
Total movement	5·17	5·2	5·33	5·3	5·02	5·1	4·98	5·0	4·73	4·6	7·23	7·3
Percentage difference between (A) and (B)	25·7	26·9	11·25	9·6	41·8	41·1	34·9	36	50·1	50·2	29·7	28·7
Percentage difference between (C) and (D)	9·6	7·7	4·69	5·6	21·1	21·5	9·6	12	20·7	21·7	3·2	4·1

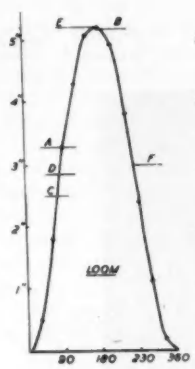


Fig. 12(a)

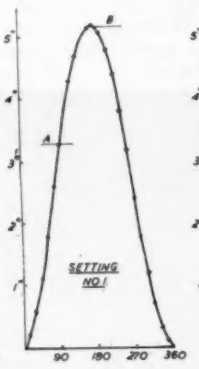


Fig. 12(b)

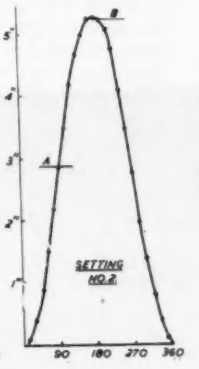


Fig. 12(c)

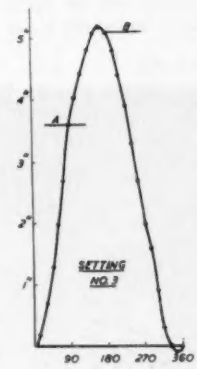


Fig. 12(d)

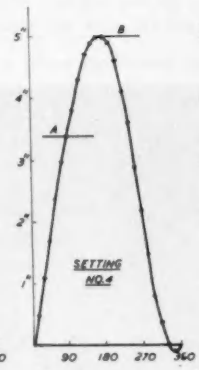


Fig. 12(e)

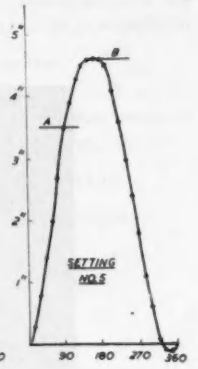


Fig. 12(f)

shuttle flight would begin after bottom centre and continue after back centre. However, the slay movement after back centre is still comparatively slow for the first 30° movement of the crank and, as the picking would never be so late as to far exceed this limit, the movement of the slay from back to top centre is not so very important. It is obvious that the most important movement of the slay is from bottom to back centre of the crank movement for this closely approximates to the shuttle flight. The movement of the slay from front to bottom centre is also important for the quicker the slay moves backwards, the larger will be the shed for the shuttle to enter as it begins its flight. This can have an effect on the size of shed and also on the size of shuttle used.

In Fig. 12(a), the loom slay movement is plotted as a displacement curve. A shows the position of the shuttle beginning its flight across the race board; B the end of the shuttle flight; C is where picking commences; D warp sheds fully opened; E warp sheds just beginning to move towards the closed position; F where the warp sheds are level. This timing of the picking has been superimposed on the displacement curves for settings Nos. 1 to 5 and these are shown in Figs. 12(b) to 12(f).

Obviously loom makers must select the settings for slay eccentricity to suit a particular loom's requirements. Whilst a high percentage of eccentricity gives the advantage of moving the slay back quickly from front to bottom centre and a comparatively slow movement from bottom to back centre, a compromise may be necessary. With fast-running looms excessive eccentricity would impart too much vibration, wear and uneven running of the loom, whilst on wider, slow-running looms a high percentage of slay eccentricity may be used without causing undue vibration.

What is equally important is the variation manufacturers impose on their looms by weaving a large variety of fabrics. It would pay the man in the mill to seriously consider just what effect these various settings have, not only on the fabric being woven, but on shuttle flight in relation to crankshaft movement, also the shed size and distance the slay has moved before the shuttle begins to enter the shed. It would also pay manufacturers to ascertain just what eccentricity is employed on their looms and to realise the limitations in relation to the fabrics that can be woven without seriously affecting shuttle flight by excessive loom settings. If eccentricity of the slay has been designed to suit a particular loom for a certain range of fabrics, then weaving difficulties will arise if an attempt is made to weave fabrics in this loom, beyond the range of its design.

New Companies

Kenridge (Textiles) Ltd. Private. Reg. Dec. 17. Capital £2,000 in £1 shares. Manufacturers and dealers in textiles and fabrics, etc. Registered office: 32 London Street, Chertsey, Surrey.

Leon Burton (Sales) Ltd. Private. Reg. Dec. 17. Capital £10,000 in £1 shares. Wholesale and retail merchants, manufacturers, importers and exporters in cottons, linen, jute, woollens, silks, etc. Registered office: 1 Cooper Street, Manchester 2.

Westwill Ltd. Private. Reg. Dec. 18. Capital £20,000 in £1 shares. Manufacturers of cotton, and textile waste, etc. Registered office: Bolton Street Mill, Ramsbottom.

F. Loxam and Co. Ltd. Private. Reg. Dec. 23. Capital £5,000 in £1 shares. Merchants and dealers in wool, noils, worsted, cotton, silk and other yarns, Registered office: Carter Street Works, Wakefield Road, Bradford 4.

P. Corot (Sales) Ltd. Private. Reg. Dec. 23. Capital £5,000 in £1 shares (500 "A" and 4,500 "B"). Manufacturers, merchants, importers and exporters of textiles, etc. Registered office: 115-117 Cannon Street, E.C.4.

Littlemead Enterprises Ltd. Private. Reg. Dec. 23. Capital £5,000 in £1 shares (1,000 6% cumulative preference and 4,000 ordinary). Manufacturers and dealers in wools, haberdashery, woollen goods, etc. Registered office: 10a Long Causeway, Exmouth, Devon.

Jersey-Jay Ltd. Private. Reg. Dec. 23. Capital £6,000 in £1 shares Manufacturers and dealers in knitted fabrics of all kinds, etc. Registered office: 7 Fold Street, Bolton.

Royton Doubling Company Ltd. Private. Reg. Dec. 24. Capital £20,000 in £1 shares. Cotton doublers and twisters, etc. Registered office: Pollard Street, Manchester 4.

Calder Weaving Co. Ltd. Private. Reg. Dec. 24. Capital £5,000 in £1 shares. Textile manufacturers, etc. Registered office: Square Shed, Mytholmroyd.

Canal Finishing Co. Ltd. Private. Reg. Dec. 28. Capital £1,000 in £1 shares. Finishers and dyers of all classes of textiles and plastic goods, etc. Registered office: Old Lane Dyeworks, Old Lane, Halifax.

Family Fabrics (Leicester) Ltd. Private. Reg. Dec. 31. Capital £1 000 in £1 shares. Drapers, merchants, and manufacturers of soft furnishings and furniture, etc. Registered office: 211A Bacup Road, Rawtenstall, Lancs.

Kirk and Steel Ltd. Private. Reg. Dec. 31. Capital £100,000 in £1 shares. Woollen manufacturers, etc. Registered office: Crank Mills, Morley, Yorks.

William Stannard and Co. Ltd. Private. Reg. Dec. 31. Capital £25,000 in £1 shares. Manufacturers and dealers in silk, cotton, wool, worsted, etc. Solicitors: Grundy, Kershaw and Co., 31 Booth Street, Manchester 2.

D. W. Huddleston and Sons Ltd. Private. Reg. Dec. 31. Capital £10,000 in £1 shares. Manufacturers, exporters, importers and dealers in woollens, worsteds, tweeds, trimmings, cotton and other textiles, etc. Registered office: Whitworth House, 115 Princess Street, Manchester 1.

Tean Hall Mills Ltd. Private. Reg. Jan. 1. Capital £10,000 in £1 shares. Cotton cloth manufacturers, etc. Registered office: 35 Church Street, Manchester 4.

Wire Healds Ltd. Private. Reg. Jan. 1. Capital £50,000 in £1 shares. Manufacturers of wire healds, jacquard harness, etc. Solicitors: John Taylor and Co., 2 Barton Square, Manchester 2.

British Textile Co., of Bradford Ltd. Private. Reg. Jan. 1. Capital £1,000 in £1 shares. Registered office: 26 Canal Road, Bradford 1.

Ward's Successors Ltd. Private. Reg. Jan. 4. Capital £2,000 in £1 shares. Wool merchants, etc. Registered office: 32 Well Street, Bradford.

John C. Burnell Ltd. Private. Reg. Jan. 8. Capital £1,000 in £1 shares. Wool and waste merchants, etc. Solicitors: Wyatt Jeffery and Co. 1 Hyde Park Place, W.2.

Finsley View Manufacturing Co. Ltd. Private. Reg. Jan. 8. Capital £50,000 in £1 shares. Manufacturers and dealers in cotton, etc. Registered office: Harle Syke Mill, Harle Syke, Burnley.

Frank Kirk Fabrics Ltd. Private. Reg. Jan. 12. Capital £2,000 in £1 shares. Manufacturers and wholesalem erchants of silk, etc. The permanent directorss re: Leonard C. Sanders and Margaret E. Sanders, both of 22 Radcliffe Road, West Bridgford, Nottingham.

Fig. 1. The imposing floodlit, exterior of Chemstrand's new "Acrilan" plant at Coleraine, W. Ireland

The Advent of Synthetic Fibres

Polyamides, polyester and acrylic fibres form, with others less well known, a new group quite distinct from the older natural fibres—cotton, wool, etc.—and the regenerated types such as viscose and acetate

By J. W. S. HEARLE, M.A., Ph.D., A.Inst.P.*

THERE are three important groups of fibres today which, 25 years ago, were unknown. These are the polyamides, polyester, and acrylic fibres: their trade names—nylon and "Perlon," "Terylene" and "Dacron," "Orlon" and "Acrilan"—are household words. All synthetic fibres they could, if necessary, be made from combinations of the chemical elements, carbon, hydrogen, oxygen and nitrogen, and are, in fact, made from simple chemical substances present in coal and oil. They form, with others less well known, a new group of fibres quite distinct from the older natural fibres, such as cotton and wool, and the regenerated fibres such as viscose and acetate, which both depend on nature for their production. By 1930, it had been discovered that the natural and regenerated fibres were composed of polymers, i.e. molecules made up of many atoms linked together in long chains. In addition, many polymers had been synthesised in laboratories. It was, therefore, natural to look for possible new fibres among the new synthetic polymers. Nylon, "Terylene," and the acrylics have been the most fruitful results so far, and the stories of their discoveries and developments make an interesting contrast.

* *Manchester College of Science and Technology.*

Vinyl, Acrylic, and Related Polymers

The tendency of certain simple substances, with the general formula $\frac{R_1}{R_2}\!>\!C=C\!<\!\frac{R_3}{R_4}$, to polymerise had been noted as an academic curiosity for a long time. In 1838, Regnault polymerised both vinyl chloride and vinylidene chloride. The reaction is a comparatively simple one as shown herewith:—

$$n\ CH_2=CHCl \longrightarrow -CH_2\text{-}CHCl\text{-}CH_2\text{-}CHCl\text{-}CH_2\text{-}CHCl\text{-}CH_2\text{-}CHCl-$$

Vinyl chloride — Polyvinyl chloride

$$n\ CH_2=CCl_2 \longrightarrow -CH_2\text{-}CCl_2\text{-}CH_2\text{-}CCl_2\text{-}CH_2\text{-}Cl_2\text{-}CH_2\text{-}CCl_2-$$

Vinylidene Chloride — Polyvinylidene chloride

This addition of simple units, following the opening of the double bond in the middle, can occur with many similar substances of which the simplest is ethylene. The nomenclature of these related substances and their polymers is given in Table 1, together with some important examples, including several well-known plastics. If two or more vinyl monomers, e.g. vinyl chloride and vinyl acetate are mixed a co-polymer can be produced in which there is a mixture of units. Thus if A and B are the two units, and —A—A—A—A—A—A— and —B—B—B—B—B— are the corresponding pure polymers, then the copolymer would be —A—A—B—B—B—A—A—A—B—A—A—B—B—A—B—A—B—B—A—. Because they

had been known for so long, vinyl polymers made an obvious starting point for commercial exploitation as new fibres. Polyvinyl chloride (PVC) fibres had, in fact, been produced experimentally in Germany in 1913; and commercial production of polyvinyl acetate, for use as an adhesive had begun in 1917.

Consequently in many countries, research on vinyl polymers was intensified in the 1920's and 1930's. Much of this research was empirical—such as making a sticky mess of polymer and then, by testing, ascertain if it was any use. For commercial success as a fibre, a polymer must satisfy two requirements:—

(1) It must be capable of extension into filaments; in 1930 this appeared to imply that it should be soluble, to give a solution which could be squirted through the holes of a spinneret.

(2) It must have suitable properties competitive with those of already available fibres.

Pure polyvinyl chloride is not easily soluble, but a copolymer containing 15% of vinyl acetate is soluble in acetone. This copolymer was made into fibres in Germany in 1928, and commercial production began in 1937 in the U.S.A. under the name of "Vinyon." An alternative method of introducing irregularity into the molecule and making it soluble is to chlorinate it, so that some of the hydrogen atoms are replaced by chlorine atoms. This was the technique employed in making Pe Ce fibres, which were produced in Germany in 1936 and can claim to be the first commercial synthetic fibres. Neither of these types of fibre were particularly good, and are not now produced. However, mention must be made of three other developments of fibres which are still in production, although their uses are limited in some respects. These are:—

1940 Saran—a polyvinylidene chloride copolymer, produced as a monofil and coarse staple fibre.

1941 Rhovyl, produced in France, following the discovery of a solvent for pure PVC.

1948-9 Vinyon N and Dynel, vinyl chloride/acrylonitrile copolymers.

The real success story undoubtedly stems from the discovery in 1940 of solvents for polyacrylonitrile. It was aided by the extensive production of polyacrylonitrile for other purposes during the war, so that a large supply of

Table 1. Vinyl and Related Polymers

Monomer	Polymer
Hydrocarbons:	
Ethylene $CH_2=CH_2$	**Polyethylene (polythene), first made in 1933:** $-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-$
Propylene $CH_2=CH-CH_3$	**Polypropylene** $-CH_2-CH(CH_3)-CH_2-CH(CH_3)-$
Styrene $CH_2=CH-C_6H_5$ **etc.**	**Polystyrene** $-CH_2-CH(C_6H_5)-CH_2-CH(C_6H_5)-$
Vinyl, general formula: $H_2C=CHR$	**Polyvinyl, general formula:** $-C(H)(R)-C(H)(R)-C(H)(R)-C(H)(R)-$
e.g. vinyl chloride $CH_2=CHCl$	**Polyvinyl chloride** $-CH_2-CHCl-CH_2-CHCl-CH_2-$
vinyl acetate $CH_2=CH(COO.CH_3)$	**Polyvinyl acetate** $-CH_2-CH(COO.CH_3)-$
vinyl cyanide, or acrylonitrile $CH_2=CH(CN)$	**Polyacrylonitrile, major constituent (more than 85%) of acrylic fibres** $-CH_2-CH(CN)-CH_2-CH(CN)-$
Vinylidene, general formula: $H_2C=CR_2$	**Polyvinylidene, general formula:** $-C(H)(R)-C(H)(R)-C(H)(R)-C(H)(R)-$
e.g. vinylidene chloride CH_2-CCl_2	**Polyvinylidene chloride** $-CH_2-CCl_2-CH_2-CCl_2-CH_2-CCl_2-$
Others, most general formula: $R_1R_2C=CR_3R_4$	**Most general polymer formula:** $-C(R_1)(R_2)-C(R_3)(R_4)-C(R_5)(R_6)-$
e.g. methyl methacrylate $H_2C=C(CH_3)COO.CH_3$	**Polymethylmethacrylate (Perspex):** $-CH_2-C(CH_3)(COO.CH_3)-$
tetrafluorethylene $CF_2=CF_2$	**Polytetrafluorethylene (Teflon)** $-CF_2-CF_2-CF_2-CF_2-CF_2-CF_2-$

Dr. W. H. Carothers

(left) Fig. 1(b). Chemstrand's "Acrilan" plant at Coleraine, N. Ireland. Each spinning machine produces continuous rolls of fibre for subsequent processing

Dr. J. R. Whinfield

polymer was available. In 1948 du Pont commenced commercial production of "Orlon." Initially, it was not very successful as a continuous filament material, but was good as staple fibre, particularly in soft knitwear. It was later followed by "Acrilan," which also had initial teething troubles, but is now a well-established fibre, being produced by Chemstrand in the U.S.A. and in Northern Ireland (Fig. 1). But the introduction of "Orlon" and "Acrilan" was only a beginning—in the ten years following 1948 a tremendous amount of detailed research was carried out on the modification and improvement of acrylic fibres, involving the introduction of other components in minor amounts in copolymers or mixtures of polymer. And it was not until this work had been done, that the really successful acrylic fibres of today were made. It resulted in improved forms of "Orlon" and "Acrilan," in addition to a host of other acrylic fibres now introduced by fibre and chemical companies in many other countries. "Courtelle," the acrylic fibre now being made by Courtaulds is one typical example. The story of the development of acrylic fibres is thus one of hit-and-miss methods, carried on over a long period of time in many laboratories all over the world. If a strong team of research workers had concentrated on polyacrylontrile in 1930, they would probably have made good acrylic fibres in a few years but, as always, it is selection of the problem to work on which is the most uncertain aspect of research.

Table 2. Methods of Polymerisation

Polyaddition	Polycondensation
The simple addition of units:	Addition with elimination, e.g.:
A+A+A+A+A+A+A	H—X—OH+H—X—OH+H—X—OH
↓	↓
—A—A—A—A—A—A—A—	—X—X—X— + 3H₂O
	or
	HO—X—OH+H—Y—H+HO—X—OH+H—Y—H
	↓
	—H—Y—X—Y + 4H₂O
Or for a copolymer:	Or for a copolymer:
A+B+B+A+A+A+B	H—X—OH+H—Y—OH+H—Y—OH+H—X—OH
↓	↓
—A—B—B—A—A—A—B—	—X—Y—Y—X + 4H₂O

Polyamides

It was actually the choice of a research problem in 1928 that led to the discovery of nylon, the first successful synthetic fibre. In that year the du Pont company invited Professor W. H. Carothers, of Harvard University (Fig. 2) to join them to lead a programme of fundamental research. They engaged a good man, allowed him to select a subject for research, and hoped that practical developments would follow. Initially, there was no particular end in view. Carothers chose to study *polycondensation*. This differs from *polyaddition* (the process by which vinyl polymers are made) in that some other substance, usually water, is eliminated when the units join up into a chain. The two methods of polymerisation are compared in Table 2.

Studying various chemical forms, the du Pont research team amassed a great deal of fundamental knowledge of the process of polycondensation, and of its products. The potential fibre possibilities of the resulting polymers became obvious and the production of a new fibre became the main aim of the research. Carothers concentrated on two types of polymer. The first—polyesters—were made by the reaction between a dibasic acid and a double alcohol:—

HOOC — X — COOH + HO — Y — OH
↓
HOOC — X — COO — Y — OH + H_2O
↓
and so on, to long chains

Fibres could be made from the polyesters produced, but none proved suitable for development. The other type was polyamides, produced by the reaction between a dibasic acid and a diamine:—

HOOC — X — COOH + H_2N — Y — NH_2
↓
HOOC — X — CONH — Y — NH_2 + H_2O
↓
and so on, to long chains

Several of these showed good fibre properties, but nylon $(—CO(CH_2)_4 \quad CO—NH(CH_2)_6NH—)_n$ was chosen for development. It was not easily soluble, so that ordinary spinning methods could not be used. The research team, led by Carothers, had to discover and carry out the technical development of another method of filament extrusion—melt spinning, from molten polymer in an inert atmosphere.

Commercial production of the new fibre began in 1938. It proved invaluable for stockings and for many war-time uses, and since the war has increased in production and achieved success in many fields, both in fashion and industry. Other polyamides have also been produced as fibres: "Perlon" is one of these. Nylon's discovery was due to a large team, with strong financial backing, concentrating initially on the problems of fundamental research, narrowing to the empirical choice of a fibre, and finally dealing with the technical problems of production, and of putting the new product on the market and into use.

Polyester Fibres

By contrast, the discovery of "Terylene" is mainly due to one man working in a small laboratory in Accrington. One of the scientists who read the scientific papers written by Carothers was J. R. Whinfield (Fig. 3), a chemist who had limited resources and other problems to work on, but who was personally interested in producing a new fibre. The firm for which he worked (Calico Printers Association) was not an exceptionally large one, and fibre production was not one of its aims; but they willingly encouraged Whinfield and gave him some facilities. Whinfield thought deeply about the characteristics needed in a fibre-forming polymer and, in particular, about the relation between molecular shape and symmetry, crystallinity, and fibre structure. He decided to investigate an aromatic ester which might behave differently to the aliphatic esters made and abandoned by Carothers. The simplest dibasic aromatic acid exists in three forms:—

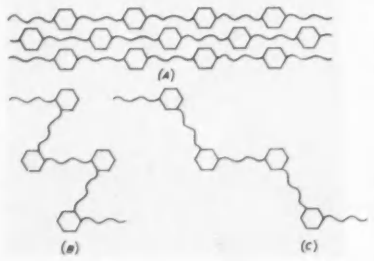
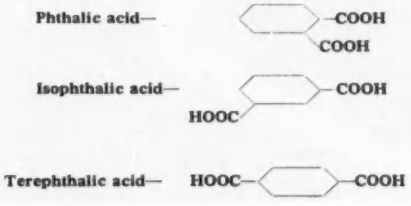
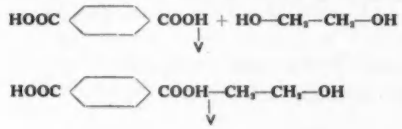


Fig. 4. Schematic illustration of close-packing in a crystal of the straight symmetrical molecules of (a) polyethylene terephthalate; this is not possible with the more complicated molecular shapes of (b) polyethylene phthalate or (c) polyethylene isophthalate



Of these, only the last (as shown in Fig. 4) has the necessary symmetry to give a compact long-chain molecule, which will crystallise and form fibres. So, in a simple apparatus, Whinfield's colleague, J. T. Dickson, condensed terephthalic acid with ethylene glycol to give polyethylene terephthalate:—



and so on, to long chains

The resulting material showed good fibre potentialities. Development was hindered by the war, and commercial production, under licence from C.P.A., by I.C.I. as "Terylene" and by du Pont as "Dacron" did not begin until 1947. It is now second only to nylon in commercial importance as a synthetic fibre.

The discovery of "Terylene" came from inexpensive, but intelligent initial research, built it is true on the extensive earlier work of Carothers and his team. The subsequent development of the polymer into a commercial fibre was long and expensive, and could only have been carried out by firms as large as I.C.I. and du Pont. In considering methods of invention, there is an immense contrast between the ways in which the acrylic fibres, nylon, and "Terylene" have been discovered and developed. But they are all now important raw materials for the textile industry, and their methods of production, properties, and uses will be described later in this series of articles.

For Further Reading:
Fibres from Synthetic Polymers. Rowland Hill (Editor).
Economics of Man-Made Fibres. D. C. Hague

Checkweighing Yarn—A New Approach to Count Variation

THAT a system of check weighing yarn for count variation hitherto applied exclusively to condenser yarns may have potentialities both as a production aid and as a quality control technique for ordinary cotton yarns was a suggestion put forward by Mr. A. Linnert, B.Sc., of Shirley Institute, in a recent address to Royton Cotton Mills Institute.

After outlining various aspects of count variation Mr. Linnert described the system and its advantages as applied to condenser yarns, with special reference to the elimination of the familiar defect of block barring in cloths using condenser weft. Thus in a 7s condenser yarn of average count variation, only 50% of the cops would have an actual count within the half count range 6¾s to 7¼s whilst even the best condenser yarn would have about 30% of the cops outside the half count range. Moreover, it had been found that in an average condenser cloth differences between adjacent cops in the cloth greater than half a count would show up as block barring, the greater the difference, the more pronounced the barring, and if all the cops in an average batch of 7s were woven together, some differences between adjacent cops greater than half count were inevitable. Against this if a 7s count yarn of average variability were sorted into three batches, each of a half count range, there would be about 50% in the half count range 6¾s to 7¼s, and nearly 25% in each of the ranges 6¼ to 6¾s and 7¼ to 7¾s, with 1 or 2% rejects outside the 1½ count range 6¼ to 7¾s. If each batch was now woven separately the result would be three cloths each quite free from block bars.

What did the system involve in practice? For all the cops produced to be checked for count, it was first necessary to put the same length of yarn on all cops or bobbins, so that the mean count would depend on the weight of the cop or bobbin, and then to checkweigh them. The first requirement, the same length of yarn on all cops, or bobbins, meant fitting measured length stop motions to the ringframes or mules and in addition, ensuring that the length of yarn lost through ends down was not significant compared with the total length of yarn on the package.

The second requirements necessitated the use of an automatic checkweighing machine, capable of weighing and sorting cops or bobbins at a rapid rate. Fortunately there were several such machines already on the market, Mr. Linnert said. In order to use the checkweighing machines at rates of 60 or 70 cops/min., it was necessary to have some device or machine for presenting the cops to the checkweigher in an orderly manner, and a machine had been developed at Shirley Institute for this purpose.

This checkweighing machine—developed at Shirley—is shown coupled to a cop sorting machine. It automatically ejects thick and thin cops on predetermined sides and perfect cops pass down the centre.

Linen Fabrics

Descriptions, warp and weft, ends and picks and related information concerning cambrics, lawns, net canvas, handkerchiefs, linings, sheetings, glass cloths, crepes, etc.

By W. MIDDLEBROOK

LINEN fabrics are probably the oldest type known to man. Thousands of years ago, Egyptian mummies were wrapped in linen and one such wrapping was reputed to have over 500 ends and picks/in. of 100s linen thread. There are all weights of linen fabrics, but the term, in many respects, has now come to mean a cloth of medium weight in the way that *calico* is used in the cotton trade to describe a medium weight plain weave cotton cloth. Fine linen was first made in England in 1253, and a company of linen weavers settled in London in 1386. In the sixteenth century hemp and flax seeds were sown in England by order of statute; the seventeenth century saw the importation of fine linen yarns from Ireland and Scotland, and Ireland is still a recognised centre of the linen trade, being concerned chiefly in the fine section of the industry. Household goods such as sheeting and damasks, handkerchief linens and dress fabrics such as lawns and cambrics are made in Ireland, the centre of the industry being Belfast; an important section of the Irish linen industry is the manufacture of linen thread. The Scottish linen trade, centred round Dundee, is concerned mainly with the coarser types of fabrics such as canvas and tickings and the spinning of heavy linen yarns for carpet, etc., manufacture. The growing of flax for the linen industry is confined chiefly to European countries such as Ireland, Belgium, France, Holland and Italy, and Russia is also a big producer.

The yarn is made from fibres of the flax plant, the stalks being "retted," "scutched" and "hackled" until the fine linen yarn is ultimately produced. The term *linen* comes from the Anglo-Saxon *lin*, meaning "a cloth made from flax." The Anglo-Saxon for *flax* was *fleax*, and the French for *flax* is *lin*; flax seed is *linseed*, an important component of *linoleum*—which is canvas coated with a preparation of linseed oil and ground cork—the word being compiled from the Latin *linum*, flax, and *oleum*, oil. *Lingerie* comes from the French, a collective noun from *linge*, linen, and the Latin *lineus*, of flax; the intimate articles of dress known as lingerie were formerly of linen. Ancient Egypt used linen for many purposes besides embalming the dead and *bad* was the name of linen used by the high priests; Ancient Greece, too, had a fine linen, usually dyed purple, called *amorgis*. A middle ages term for a fine linen fabric in England was *ailesham cloth*, from the town of Aylesham.

There is not a very wide range of dress fabrics in linen, but the cloth has valuable properties apart from being cool and crisp; one always thinks of "cool linen" being worn in tropical countries. *Cambrics* and *lawns* are perhaps the most widely used in the dress trade, the former, named after the French town of Cambrai, being also made in fine Egyptian cotton yarns as a fine plain fabric. *Cambrasine* is a fine linen cambric dress material, as also is *batanores*. *Lawn* is another fine linen—also made in cotton—named after the French town of Laon; sleeves worn by bishops are called *lawn*. There are various grades of *lawn*, both in cotton and linen, including *Indian*; *Victorian*, with a stiff finish; *Persian*, with a soft finish; *bishops' lawn*, bleached and finished with a blue tint; *boiled linen*, a finely-set dress fabric of flax yarns, and *sheer lawns*, pure linen cloths. Other dress fabrics of linen include *chambray*, used also for overalls and aprons; *linen batiste*, 86×78, 110/140s leas; *shamrock lawn*, *Sussex lawn* and *cobweb lawn*.

There are fine linen linings, such as *brin*, 68×68; *interlinings*, with from 40 to 60 ends and picks/in. of 25 to 30 lea yarns, used by tailors; and *roughs*, also used by tailors for linings, being a finer cloth of the *duck* type. *Pocketing*, also used by tailors, this may be of cotton, linen, jute or nylon. *Net canvas* has an open weave, black or bleached, and is stiffened for embroidery; *Barnsley linens* are embroidery cloths also, and *art linen*, in white, tan or ecru, is an embroidery cloth used for cushion covers, tablecloths and table centres. *Amabouk* is a plain linen of coarse yarns that may be bleached for shirtings or unbleached for bags. *Rochelle shirting* is made with 80s to 90s lea counts, 80 ends and picks/in. *Linen handkerchiefs* have from 40 to 100 ends and picks/in., 50s to 110s warp and 60s to 140s weft, using fine boiled line yarn, the long fibre of flax separated from the tow and spun up to 300 leas; tow yarns are thicker and more irregular.

Balloon cloth may be of fine linen, while *brattice cloth* may be of jute or coarse linen, being used for wind and ventilation screens in mines, being specially treated to make it rot- and fire-proof. A *brattice* is really a plank or brick lining or partition in a mine shaft, forming an air control, *brattice cloth* taking the place of such a solid partition; the name comes originally from the Greek *brett*, meaning a plank or board, the Latin *breta(s)chia* and the French *breteche*. *Étamines* is a gauze or network fabric that may be of linen, the French *étamines* meaning a sifting cloth, bolting or bunting. *Ensign cloth*, used for flags and bunting, may be of linen and *basin royal* is a linen tick, a striped fabric. Fine quality *glass cloths* are of linen, and may be plain weave or a simple 4-shaft weave such as 2×2 basket, small matt or huckaback; other simple linen cloths for domestic purposes are *jago* and *basmas*. *Bastancini* is another plain linen of fine quality, with a stiff finish. *Byssus* is a fine linen made from yellowish flax, and is another name for the "fine linen" often mentioned in the Bible, linen in which priests and kings were robed.

Heavy Plain Linens

Holland, so-called because it was first made in that country, is a coarse linen cloth used for window blinds and furniture covers; when unbleached it is called *brown holland*. *Barnsley crash* is a narrow, rough linen towelling

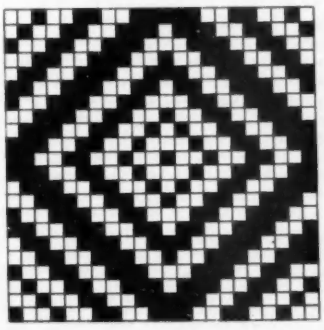
fabric; *crash* is really a coarse linen cloth used for towels and dishcloths, the French name being *grosse toile de fil*, but the name was first used of a Russian material, a coloured linen called *krashenina*. One quality of *linen crash* is 24×24, 22s/22s leas. There are several *canvas* or *duck* fabrics of linen, such as *Russian duck*, a fine bleached linen canvas used for summer dresses; *composition cloth*, a waterproofed linen duck; *mummy canvas*, a closely-woven linen with a brownish colour; *roughs*, used for tailors' linings; *navy canvas*, an open-weave fabric that is stiffened for embroidery; *baline* and *tarare*, coarse canvas cloth used for aprons, tailors' linings and furniture covers. *Butchers' linen* is another strong and heavy linen used for aprons.

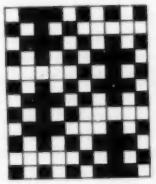
Osnaburg, once a coarse linen fabric from the German town of Osnabrück, is now more usually made with cotton, in stripes or checks; *duster cloth*, too, may be of cotton as well as linen, a plain-weave dustproof material for coats. *Linen sheeting* may be plain weave or 2×2 twill, while a specially heavy sheeting is made from a 5-end satin weave. *Burlap* is a coarse cloth of jute or linen, used for wrapping, the name being a corruption of the Dutch *boenlap*, a rubbing clout; *sackcloth* also is a rough linen or hempen fabric, originally of goat's hair, one of its uses being as a penance garb. *Buckram* is a strong linen, stiffened with a paste such as china clay and glue; it is said to have come from Bokhara, but another derivation gives the Italian *bucherare*, meaning "to pierce full of holes"; it is used for artificial flowers, bookbinding, caps, hats and shoes. Plain shirting material, 72×80, 80s/90s lea counts is called *rochelle shirting*, and another plain linen of coarse yarns, 28 ends and picks per in., entered one end per dent, is *laisot*, used for dresses. *Cable mattings*, 20×24, 6s/8s lea counts, have a 2×2 matt weave.

Canvas is a general term describing a strong, heavy plain cloth of flax, hemp or jute, though cotton is also used; the name comes from the Sanskrit *cana*, which means hemp; *duck* is another term for canvas-type fabrics of linen or cotton, and there are various explanations given as to the origin of the word; one derivation is from the Dutch *doek* and the Swedish *duk*. The modern *dowlas*, named after the French town of Daoilas near Brest, is a strong calico used for aprons, overalls and linings; in the sixteenth century it was a coarse linen fabric worn as smocks by the lower classes.

Linen Twills and Fancies

Simple 3-end twills are used to make *brattice cloth*, which may also be a plain weave. *Ravensduck*, a heavy Dundee sailcloth, is also a 2×1 twill weave, and *marsella linen* a 2×1 or 2×2 twill suiting fabric of heavy yarns and a low reed and pick rate. *Flax drills* for suitings and riding breeches may be 2×1, 3×1 or 5-end satin weaves, 76×60, 36s/40s leas. *Linen sheetings* may be 2×2 twill or specially heavy with a 5-end satin weave, one example of the twill being 60×44, 36s/40s and of the satin, 72×42, 48s/50s. Tea towels may be made of *drabbet*, a twilled linen made at Barnsley. *Gambroon*, named after a Persian town, is a twilled linen for linings and trousers.





(above) Fig. 57
(left) Fig. 58

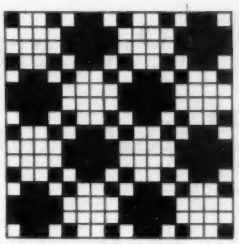


Fig. 59

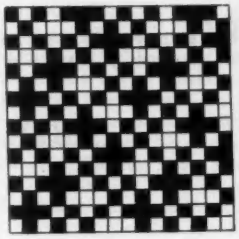


Fig. 60

The huckaback weave, shown at Fig. 57, is a popular weave in the linen trade for towels and glasscloths. *Huckaback* once described a coarse material of linen or cotton that was carried from door to door by pedlars, the low German *hukkebak* meaning the pick-a-back carried by pedlars; the fabric had a name for long wearing qualities, and Horace Walpole used it in his "Letters" when he said: "Campbell goodness no more wears out than Campbell beauty; all their good qualities are huckaback." *Glass cloths* may be made with a small matt weave, 2×2, or a huckaback; *elephant towelling* is a rough-faced material of cotton or linen with a huckaback weave, and is used for embroideries and drawn thread work as well as towelling. *Basket huckaback* is another towelling fabric of linen with an 18×18 huckaback weave. *Russian diaper* is a linen fabric with a double diamond or diaper design, similar to the one shown at Fig. 58; a mock leno weave, shown at Fig. 59, is used for *ida canvas*, a soft linen of unbleached yarns for dress and embroidery work.

Linen crepes are not made with crepe yarns, but have an irregular cloth surface from the weave; *linen tussore* is another dress goods fabric in stripes and checks. A pinhead or oatmeal weave is used for what is known as *oatcake linen*, and *crash* also may have the oatmeal weave, an example of which is shown at Fig. 60. *Damask* was originally a silken fabric from Damascus, but is now made in both cotton and linen, with ornate jacquard designs and usually a reversible cloth, used for tablecloths, bedspreads, cushion covers, draperies, fancy work and embroideries, neckties and scarves, screens and partitions, toilet kits, toys, upholstery, wall coverings and table napkins. *Single damask* has a 5-end satin ground with jacquard figuring, and *satin damask* is another variety, used for the best grades of table linen.

More Hosiery Bought in Canada

Canadian women purchased an average of 12·7 pairs of nylon stockings during 1959, making ladies' hosiery one of the few apparel items with a higher per capita consumption in Canada than in the U.S., report the Canadian Association of Ladies' Hosiery Manufacturers. Issuing figures for 1959, the Association reported that domestic mills shipped 5,605,000 dozen pairs during the 12 months period, an increase from the 5,275,000 dozen pairs total recorded for 1958, and 4,936,000 in 1957. Per capita consumption inched to 12·7 from 12·2 in 1958, and 12·0 in 1957. The figure for per capita consumption in the U.S. rested at 12·1 pairs. For the first time total for seam-free ladies' hosiery, 3,193,000 dozen pairs overtook shipments of full-fashioned stockings, 2,412,000 dozen. Total imports of ladies' hosiery rose from 522,000 dozen pairs in 1958, to 560,000 dozen pairs in 1959.

"Terylene": Properties, Uses and Possibilities*

By F. F. GOODYEAR, A.T.I. †

ONE obvious property of "Terylene" is high strength. In medium and heavy apparel the extra strength obtained by the incorporation of "Terylene" is not essential (although it is useful in giving extra life to a garment), as fabrics of adequate strength can be made of wool alone. The extra strength—which is accompanied by high resistance to abrasion is of real value in lighter fabrics. As lighter fabrics are produced the strength falls and in the lightest fabrics of all the only way to obtain adequate strength is by the inclusion of very strong fibres. Featherweight suiting fabrics are being produced from blends of "Terylene" and wool as fine as 2/80's worsted giving cloths of the order of 6 ozs. In the woollen spun field fabrics have been produced from yarns spun to 54's Yorkshire for use as lightweight skirtings.

"Terylene," a thermoplastic fibre, can be heat set to give dimensionally stable fabrics, and a heat setting process is applied to many of these lightweight fabrics that are destined for the American market. The highly successful durably pleated skirt is possible because of this thermoplasticity. The skirt panel is folded between cardboard formers of suitable shape and the assembly is then steamed. Provided the treatment is properly applied to a correctly constructed fabric, pleats inserted in this way have given satisfaction for a number of years. Although the "Terylene"/wool pleated skirt is the best known, it must be realised that 100% "Terylene" and suitable blends with other fibres can be pleated satisfactorily. There are now on the market 65/35 "Terylene"/viscose fabrics in pleated skirts and men's slacks. These are aimed at a lower price bracket than the corresponding 55/45 "Terylene"/wool garments but contain similarly durable pleats and creases. "Machine pleating" can be applied to suitable 100% "Terylene" and blend fabrics for the production of some types of pleated dresses and skirts, and for the embellishment of curtain fabrics.

Until recently the "Terylene"/wool fabrics being produced tended to be made in the simpler weaves. Much experience has been gained on their properties and behaviour, and the range of fabric types is now being extended. Trouserings in Bedford cords and in cavalry twill are now produced by many firms. Surface interest is being introduced into fabrics for women's skirts and costumes by the use of fancy weaves and by prints. The "Terylene"/wool woollen spun fabrics have established themselves in the sports coating and suiting field, and the range of fabrics of this type is also being expanded by the use of weaves other than plain, which enables a wider variety of effects to be produced.

The 65/35 "Terylene"/viscose skirtings are made from cotton-spun yarns, and Lancashire is making a wide range of "Terylene"/cotton fabrics that are finding applications in shirtings, dress goods and lingerie. In these apparel fabrics the resistance to accidental creasing—especially in the damp state, and the ability to insert durable creases and pleats are properties of prime importance and these properties are of equal value in clothing made from filament yarns, and in these very quick drying results from the low water absorption of the fibre. Interesting effects are achieved by embossing "Terylene" fabrics and lustrous patterns can be obtained by flat embossing a white or dyed fabric. If undyed fabric is embossed and then dyed, it is possible for the parts that have been subjected to heat to dye to a different shade to the remainder.

Bulked Yarns

Probably the most interesting effects that can be produced on "Terylene" are the various types of "bulking" or texturising of the filament yarns. A fabric made of normal filament yarn tends to be smooth and shiny, rather transparent in relation to its weight and rather cold to the touch. Filament yarns can be modified in various ways to give them some of the properties of spun yarns, such as bulk and warmth, and, at the same time they maintain the virtues of the filament yarn. The usual way of doing this is a twisting technique, where the filament yarn has a very high twist inserted and is then heat set. After heat setting the twist is removed and although the yarn now has again no twist, it has a tendency to return to its twisted state and will if relaxed develop "bulk" due to the torsion of the individual filaments. Many yarns of this type have a high degree of stretch, and they were first used in the production of stretch socks for men. Nowadays the bulk and loft of this type of yarn is exploited more than the stretch character.

"Terylene" can also be texturised by the stuffer-box technique ("Ban-Lon") or like any filament yarn by the "Taslan" air-jet process. A wide variety of knitted and woven fabrics is being produced from these various bulked yarns, and I am confident that these developments represent what will be a most important field of activity in the future of Textile Industry. Woven fabrics made from false twist "Terylene" can be finished to give stable materials, and very interesting results can be obtained from combinations of different types of yarns. The idea of continuous filament hand knitting yarn becomes a practical possibility when using these techniques.

So far the uses of "Terylene" in industrial applications has not been mentioned, but here its great strength is important. A "Terylene" rope is about four times as strong as a similar rope made of natural fibre and has a number of other advantages. It does not swell on wetting, and so is not stiff under those conditions, and the low moisture absorption means it does not have the same increase in weight as a natural fibre rope. The resistance to micro-organisms such as mildew is an obvious advantage. These properties are also turned to account in such applications as fishnets and sails. These are not all the applications of "Terylene" on the sea but simply illustrations of its value.

On land, industrial uses of "Terylene" are very wide indeed the combination of strength, chemical resistance (especially to acids) and low water absorption making it an ideal fibre for many applications. For example, many types of protective clothing can be made from "Terylene" either in the form of 100% "Terylene" fabric, or, when a completely impervious fabric is required, a coated material may be used. Coated fabrics are made into a wide range of protective clothing, mainly utilitarian in design, but coated fabrics can be made into rainwear, and here fashion can take a hand. Rainwear of this type is frequently produced in fancy prints or bright colours, so that a rainy day need not be a drab one—so far as ladies are concerned. Conveyor belts, driving belts, hoses and laundry fabrics can be produced in wide variety from "Terylene." Non-woven fabrics produced from batts of "Terylene" can be used for lining fabrics, filter media, and for electrical insulation, the properties being varied by the types of rubber used to bond them.

Household textiles also offer wide scope for "Terylene," and a large proportion of filament yarn production goes into curtain nets. In these the resistance to damage by sunlight is a valuable property, while washability is also important. The material is heat set so that there is no risk of shrinkage, and the low water absorption makes them very quick drying; this, combined with the resistance to creasing gives curtains that can be washed and rehung the same day. Ease of washing is also an attractive feature of tablecloths made from "Terylene." These made from filament yarns in damask designs are not only useful in the home, but are being employed by institutional users such as hotels, railways and shipping lines. Quilts and pillows filled with "Terylene" maintain their bulk, softness and shape because of the good resilience of the fibre.

South African Cotton Crop

In a message from South Africa, Barclays Bank D.C.O. reports that 1959 cotton production (including Swaziland) reached the record figure of 34,500 bales, although it did not attain the expected figure of 37,000 bales lint (500 lbs. each). The previous record was established in 1955 at 32,800 bales while the 1958 crop amounted to 26,500 bales. Production in the dryland areas of Barberton, Natal and Swaziland proved a record in yield and quantity. The crop from the Upington area, however, was somewhat disappointing. Final estimates for the latest season (based on lint classifications and ginners' returns) were 19,200 bales from the Western area (irrigated) and 15,300 bales from the Eastern area (dryland).

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* *From a paper given recently to Batley and District Textile Society.*

† *Manager, Technical Service Dept., I.C.I. Ltd., Fibres Division, Harrogate.*

Book Reviews

TEXTILES. R. Thiebaud. Dunod, 92 Rue Bonaparte, Paris 6e.

The name Dunod has justly acquired international prestige in the field of scientific and technological publication and these three manuals, issued in the Aide-Memoire series, in no way detract from that reputation.

The first volume describes the various textile materials available and methods of spinning them and volume 2 deals with weaving and its preparatory processes. Dyeing and finishing are covered in the third volume.

Each volume presents most concisely essential data and formulae, with drawings and tables, for each process. These volumes are of handy pocket-size, neatly printed and bound.

S.P.S.

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DIE SCHWEIZERISCHE TEXTILINDUSTRIE IM INTERNATIONALEN KONKURRENZKAMPF. Prof. Dr. A. Bosshardt, Dr. A. Nydegger and Lic. Oec. H. Allenspach; Polygraphischer Verlag AG. Zurich and St. Gall 1959; p. 356 (price S Fr. 41).

Structural change in the cotton industry is not a feature exclusive to Lancashire, but can be observed in most Western European countries. Switzerland is a case in point, and it is interesting to see how the relatively small and adaptable textile industry in this country has fared in the turmoil created by increasing competition from low cost producing countries. In this comprehensive analysis of the Swiss textile industry, the authors' main conclusions are that the industry is going through a period of adjustment, the causes of which have been both technical and commercial. Increasing use of man-made fibres, development of new finishing processes, the rise of newly established and highly competitive textile industries in overseas countries and the movement towards a closer integration of the European market have all contributed to this situation. Present difficulties cannot be overcome by patchwork relief solutions. Only long-term planning and adjustment can solve the problems and maintain the competitive position of the Swiss textile industry in a changing world.

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MANUAL OF THE TEXTILE INDUSTRY OF CANADA 1959. Canadian Textile Journal Publishing Co. Ltd., 223 Victoria Avenue, Westmount, Montreal 6.

By means of a number of articles contributed by experts this 31st annual edition conveys a clear picture of the Canadian textile industry, particularly as it is affected by the Minister of Finance's directive to the Tariff Board which has led to the first full review of the tariff schedules for 30 years.

An excellent directory section covers most fully both textile products and chemical specialities made for textile service and there are a number of statistical tables showing the structure of the domestic industry and the sources of supply.

WELDING OF PLASTICS. J. A. Neumann and F. J. Bockhoff. Chapman and Hall, 37 Essex Street, London, W.C.2 (price 58s.).

HEATSEALING AND HIGH FREQUENCY WELDING OF PLASTICS. H. P. Zade. Temple Press Ltd., Bowling Green Lane, London, E.C.1. (price 35s.).

These two volumes are in great degree complementary, so much so that students and plastics practitioners would be well advised to secure copies of both books. Neumann and Bockhoff are chiefly concerned with three techniques for the welding of thermoplastics and with the choice of the optimum weldable plastic, at minimum cost, for a given application. The three methods studied are hot-gas welding, heated-tool welding and friction welding, but other techniques and special applications are briefly considered. Much of the information given is drawn from the authors' wide experience with Du Pont and American Agile and ranges from initial design procedures to detailed fabrication techniques.

Many step-by-step procedures are described and illustrated. Appendices provide, *inter alia*, a glossary of terms and an exceptionally good corrosion resistance table. Quite a number of materials newly introduced, including the newer fluorocarbons, are covered in detail.

Dr. Zade, who has been an active participant in the plastics industry for many years, concentrates his attention on the two processes indicated in the title of his work and offers an authoritative and up-to-date picture of the present state of knowledge of these methods and their applications, supporting his text by many illustrations and numerous references to the literature. Information on the physical properties of thermoplastics as affecting their welding properties and the selection of suitable equipment is comprehensively supplied. Two particularly valuable features are the index of international patents, with over 400 entries, which illustrates the growth of welding methods over the past 18 years, and an index of British American and other trade names of thermoplastics.

S.P.S.

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DIRECTORY OF OPPORTUNITIES FOR GRADUATES, 1960. Cornmarket Press Ltd., 1 Lower James Street, London. 1959. pp. 248 (price 8s. 6d.).

This directory should be very useful to the university graduate; it is an excellent guide to the prospects and opportunities offered by over 270 industrial and commercial firms and organisations. The directory aims to ease the flow of students from university to industry by providing the graduate with current information about the firms that need him and the opportunities available. A classified index summarises in tabular form information about the size of firms and organisations, whether men or women are employed, and the areas in which employment is offered.

Apart from the well compiled reference section, the editorial section has authoritative articles on the changing pattern of graduate employment, and on other subjects. It is stated that 20,000 copies of the directory are distributed, free of charge, to all final year students at every university in the U.K. A very commendable gift, one can only hope that it will be studied and appreciated. As The Rt. Hon. The Lord Godber (Shell) says in the preface "it is of the first importance both for the individual and the nation that talent should not be wasted and that every man should find the career in which he will do best." It is for this purpose that the directory has been compiled and published.

B.S.

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CABMA REGISTER 1959 - 60. Published jointly by Kelly's Directories Ltd. and Iliffe and Sons Ltd., for the Canadian Association of British Manufacturers and Agencies (price 15s., post free).

The CABMA register is said to be the Canadian buyers' standard work of reference and the degree of completeness and efficiency attained by this edition has once again been made possible by the full co-operation of the following sponsoring organisations: the Dollar-Sterling Trade Council in Canada and, in the United Kingdom, the Dollar Exports Council, the Federation of British Industries, the National Union of Manufacturers and the Scottish Council (Development and Industry). The buyers' guide lists alphabetically some 3,000 British products available to the Canadian market, with their suppliers given under each heading. The French equivalents of these headings are set out in alphabetical order in a separate glossary. A directory of nearly 4,000 British firms gives details of their distribution arrangements in Canada, and includes proprietary names and trade marks in special sections which enable the Canadian buyer to identify products and their sources of supply. All six sections of the Register are easily identified by the slotted index and the tinted paper.

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SKINNER'S COTTON TRADE DIRECTORY OF THE WORLD. Thomas Skinner and Co. (Publishers) Ltd., St. James House, 44 Brazennose Street, Manchester 2 (price £4).

The Government scheme for the reorganisation of the Cotton industry has resulted in the closure of many Lancashire mills, and the publishers point out that, where possible, these closures have been recorded in the 1960 edition. Apart from these deletions, little change is apparent in the new volume which has all headings and indicators printed in French, German, Spanish, Italian and Portuguese. Coloured thumb-indexed sections contain a mass of information on British spinners and manufacturers, dyers and finishers, packing and transport, tufted textiles, fabrics and household textiles, together with a comprehensive list of mill suppliers, indexed generally and by subject. Other notable features are lists of associations and institutions, statistics, and an alphabetically listed section on raw cotton importers, merchants and brokers.

Recent Advances in High Tenacity Rayons*

The improvement in rayon tyre yarns is a continuing process. Current work suggests it will be possible in the near future to produce yarn with an oven dry tenacity of 6·5 to 7·0 grams/den.

By E. V. REEVES†

HIGH tenacity rayon first made its appearance in 1935 and rapidly gained acceptance for industrial purposes, mainly for the reinforcement of pneumatic tyres. At that time, the material in common use was cotton, but with various technical advantages to be gained by using rayon and with availability during the war, it was inevitable that the tyre yarn market should be taken over by this new high tenacity man-made fibre. In 1958, 86% of all tyre fabric made in the U.K. was made from high tenacity rayon.

The first of these rayons was manufactured on machines used for the manufacture of textile yarns. The spinning solution was made in a batch process and after extrusion and coagulation in the acid spinning bath, the yarn was subjected to a stretching treatment in hot dilute acid and fed through a vertical glass funnel into a rotating cylindrical box. Through the traverse motion of the funnel and the centrifugal force exerted on the yarn by the rotation of the box, a hollow cake was built up, which could be removed and subjected to a separate processing treatment. This rather discontinuous method of manufacture was relatively uneconomic. Since 1950, most of the tyre yarn in this country has been manufactured on continuous spinning machinery where, through the use of a self-advancing reel, yarn could be stored on the surface of the reel (as a spiral wrap) and processed with washing, desulphurising and lubricating liquids, before drying in the same way. A diagrammatic sketch of the two methods of manufacture is given in Fig. 1.

Apart from making the method of spinning the yarn continuous, it is also desirable to make the methods of viscose manufacture continuous, viscose being the spinning solution. Such a process has been investigated and has been in use to a limited extent for some time. It involves a continuous flow system, where any chemical or physical changes in the viscose (e.g. ageing and filtration) can be achieved during the

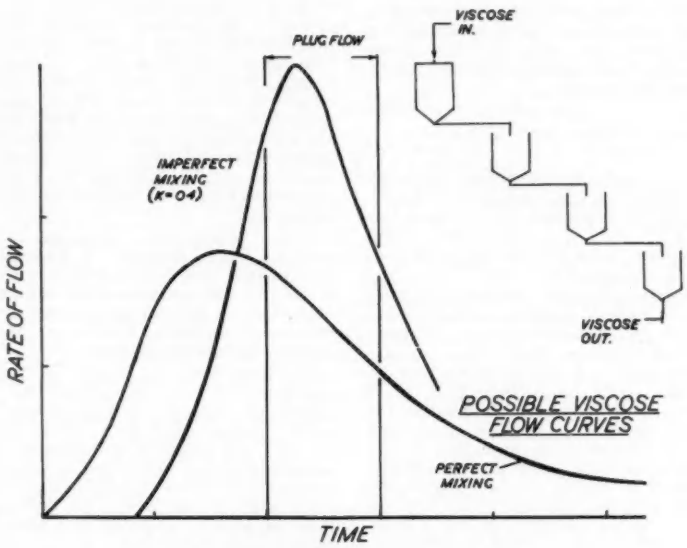


Fig. 2. The illustration shows the type of viscose flow pattern

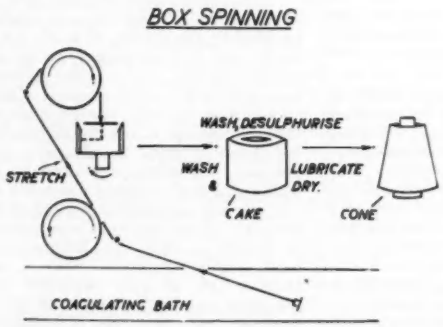


Fig. 1(a). Diagrammatic sketch showing box spinning method previously used but now considered relatively uneconomic

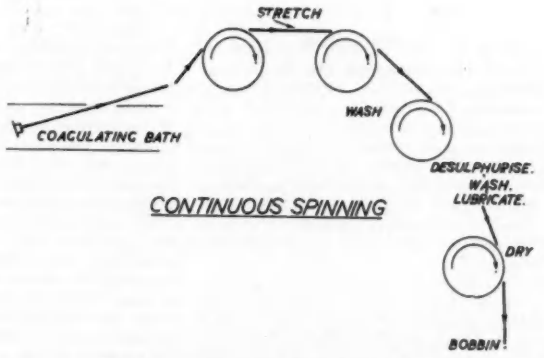


Fig. 1(b). Continuous method of spinning, now generally accepted in this country

* *A paper given recently to Shipley Textile Society.*

† *Courtaulds Ltd., Viscose Research Laboratory, Coventry.*

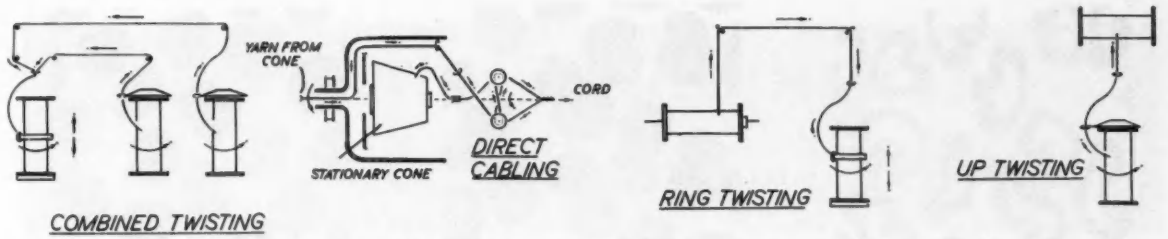


Fig. 3. Combined twisting employs uptwisting for the singles yarn and ring doubling to make the cable. In direct cabling the singles yarn is only false twisted and the effects of the twist are minimised.

passage of the solution through the system. It is essential that the flow pattern should be well understood and to that end, many theoretical calculations and experimental determinations have been made. Fig. 2 illustrates the type of flow pattern which might be found—whereas, a particular volume of raw material introduced into the system might be expected to leave the system as a plug, in fact, it leaves in the manner illustrated.

Continuous spinning and continuous viscose manufacture are only two of the advances made in the plant for the manufacture of high tenacity rayon. There are also, of course, many other changes which have been made over the past ten years, to improve the properties and other characteristics of the yarn. Most of these are concerned with changes in the chemical process of spinning.

The need to improve the physical and chemical characteristics of high tenacity rayon arises in the same way as it does in any other industry, where it is essential to improve the product continually, in order to meet the increased demands made upon the product and to keep ahead of competitors. Since the war, vehicles of all kinds have been demanding better performance from their tyres; higher speeds, greater loads, fewer failures. To meet these demands, it is essential for the heart of the tyre, that is, the textile carcass, to have improved strength, better dynamic performance, improved stability at higher temperatures. All these factors have been considered when the process of manufacturing high tenacity rayon has been modified.

The most important characteristic of a tyre yarn, when considered by most tyre designers, is the strength per unit cost of the material. To this end, therefore, it is the task of tyre yarn manufacturers to produce the strongest yarn at the lowest cost. If the contributing parameters are analysed, it may be shown that the ultimate factors are tenacity and cost per unit weight. Over the past seven years, by continuous research, it has been possible to raise the oven dry yarn tenacity of rayon yarns from 4·0 grams/den. to 6·0 grams/den., while the cost of such yarns has risen from 46d. per lb. to only 51d. per lb., so that it is fairly obvious that the tenacity/cost per unit weight ratio has been greatly increased, to the tyre manufacturer's benefit. It is now possible to obtain a high tenacity rayon yarn commercially, with a wet strength equal to the oven dry strength of the earliest material.

It is necessary to convert the yarn, first to cord form, and then weave the cord into a fabric, before it can be used for the manufacture of tyres. The process of cording has undergone several changes over the past few years. Whereas the earlier type of twisting, namely the ringframe, is still used on a large scale in the industry, other methods have been introduced. These include uptwisting machines, combined twisting machines and direct cabling machines. The process of cording involves twisting the yarn into a cord, usually two-fold, so that the yarn has a fixed amount of residual twist as it lies in the cord—this amount usually varies between zero and 2 t.p.i. The two important developments are those of the combined twister and the direct cabler, the principles of which are shown in Fig. 3. With the combined twister (which combines uptwisting the singles yarns and ring doubling to make the cable), the singles twist stays in the yarn for a relatively short time before it is removed in the cabling operation, while in the direct cabler, the singles yarn is only false twisted and the effects of the twist (which may lead to filament entanglement) are minimised. Both types of machine introduce large savings in time and handling, and it is to be expected that more machines of these types will be used in the future.

Strength Considerations

Much work has been done to find the conditions under which the translation of yarn strength to cord strength is a maximum. Many theories have been produced which should provide a reasonable basis on which to calculate the expected cord strength from a given yarn. Apart from the obvious effect of twist construction, it is certain that the most important parameters determining cord strength will be filament cross-section (which affects the packing of filaments in the cord), lubricant and lubricant distribution, filament entanglement and possibly the transverse force which is introduced during loading. The last-mentioned effect will certainly diminish free filament movement just as the absence of lubricant will do so, and it is quite possible that the stronger yarns which cause larger transverse forces before they break, will limit their cording efficiency, unless superior lubrication is forthcoming.

Table 1. Progress in Rayon Cord Strength
Cord construction 2/1650, 12 × 12

Cord	Oven dry cord breaking load (lbs.)	Year
"Tenasco"	23	—
"Tenasco" 35 ..	28	1953
"Tenasco" Super 70 ..	31	1955
"Tenasco" Super 105	35	1957
Development yarn ..	40	1958

Increases in yarn strength have been obtained through modifications in the chemical process of regenerating the cellulose in a new form, i.e. as a filament. The general approach has been to alter the process of coagulation after the viscose leaves the spinning jet—these alterations have led to a much more uniform structure in the filaments, with a resultant increase in the efficiency of the load-bearing microstructural elements. This uniformity, which can be assessed in a number of ways, using physico-chemical techniques, can be seen in the development of the filament cross-sections through the range of viscose high tenacity yarns. Fig. 4 a to e, illustrates these cross-sections, and Table 1 lists the properties of tyre cords which can be made from some of them.

Apart from strength, however, it is necessary that the tyre cord will behave well under dynamic conditions. This involves behaviour under the constant application of tension and compression which is found in a rolling tyre, and acceptable behaviour under impact conditions which are prevalent when a tyre meets a rock or pot hole when rolling at speed. These conditions are often accompanied by relatively high temperatures due to the heat generated in a tyre by hysteresis and friction, so that they must usually be studied at high temperatures. At the same time, the tendency for dimensional changes to take place in tyre cords is higher at high temperatures and it is therefore necessary to be confident about the ability of the cord to maintain its length while under load and at an elevated temperature.

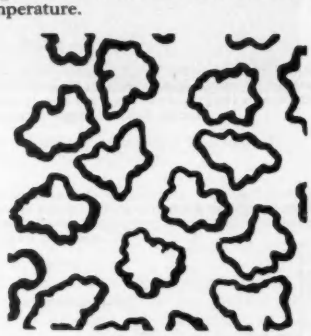


Fig. 4a. Textile

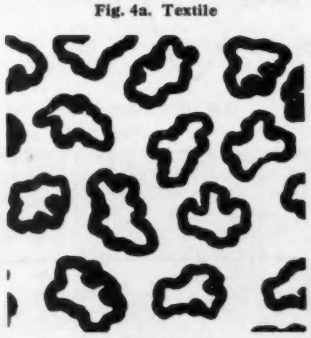


Fig. 4b. Tenasco

Fig. 4c. Tenasco 35

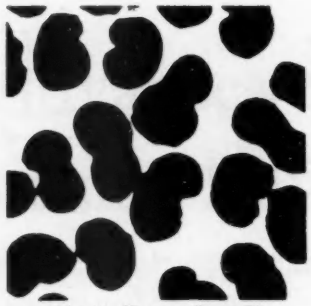


Fig. 4d. Tenasco Super 70

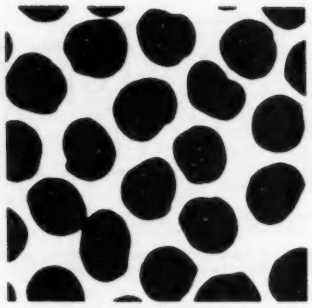


Fig. 4e. "Tyrex"

Evaluating Performance

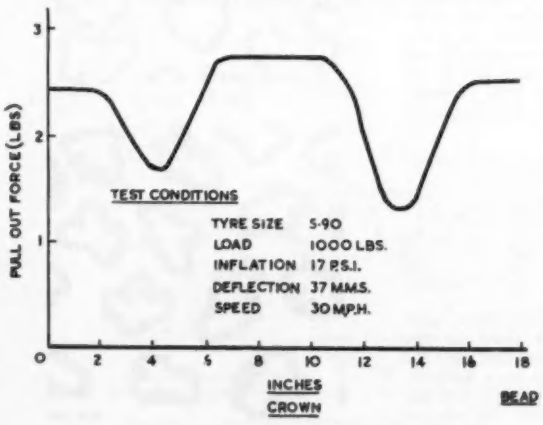
The most common method used for evaluating the dynamic performance of a tyre cord, is to embed it in rubber, either alone or with a number of similar cords, and subject the composite piece to compression and/or tension cycles. Such tests are usually called fatigue tests. Typical tests include those where the cord under test is moulded, as part of a weftless fabric, in a belt; above the layer of cords is a layer of steel cords, which serve to compress the textile cords when the belt is bent over a pulley with the steel cords uppermost—by reciprocating a short length of the belt over the pulley, with a normal force applied, the textile cords are found to lose strength with time, and this is a measure of their fatigue resistance. There are many other tests serving the same purpose. However, it is not certain that "classical fatigue" of the tyre cord material takes place at all; in fact, recent evidence (1), (2), indicates that the cause of cord failure is primarily due to a failure of the adhesive bond between the tyre cord and the rubber, or to a cohesive breakdown in the skim rubber which is applied to a thin layer next to the fabric. If this is so, then in order to obtain the benefits which can accrue from the use of the latest rayon tyre yarns, it will be necessary to prevent this breakdown by the use of better adhesives and rubbers with improved dynamic characteristics. Fig. 5 illustrates the effect of this adhesive or rubber breakdown, as it shows the force required to pull out a cord from the inner ply of a used tyre, from one bead across the tyre section to the other bead; at the "flex" region in the tyre, this force is a minimum, due to the failure of the adhesive or skim rubber.

It has been well demonstrated (3),(4), that the work of rupture of tyre cords, i.e. the energy absorbed in breaking the cords, increases with rate of loading. This has been demonstrated in the laboratory with various types of impact loading. It has also been demonstrated in practice with tyres (4) that even with severe impacts (for example, hitting a 6-in. high kerb at 30 m.p.h.) tyre cords will withstand the force applied. The increase in the work of rupture is due to the increase in the breaking load of rayon cords, with no change in extensibility; since the latest rayon cords have even higher extensibilities than their predecessors, they also have an increased work of rupture, so that it may be expected that they will out-perform the earlier rayons under impact conditions.

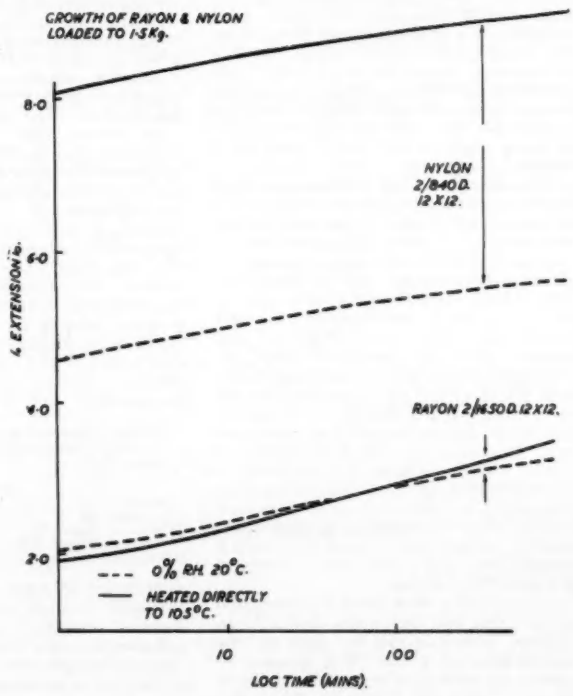
High temperature characteristics can be measured in a number of ways. The most common method involves the measurement of the increase in length of the tyre cord when suspended under load at high temperature (100°C.). This creep will be an indication of the possible effects in a tyre, where each cord may be under a tension of about 2 to 3 lbs. due to the inflation pressure. If the cord extends too easily, then the tyre may be expected to "grow" with resultant tread and side-wall cracking. The latest high tenacity rayon cords have been tested in this way and compared with nylon. The latter material has a much lower "modulus" than cellulose and hence, suffers from a much larger "initial extension" when the cord is loaded. Nylon also contracts at high temperatures, so that if the cord is not allowed to contract before the load is

(*continued on page 78*)

(Below) Fig. 5. Illustrates the effects of adhesive or rubber breakdown, showing the force required to pull out a cord from the inner ply of a used tyre, from one bead across the tyre section to another bead



(Right) Fig. 6. The graph shows some results of a well-known method of measuring high temperature characteristics. The increase in length of the tyre cord is measured when suspended under load at high temperature



TEXTILE MACHINERY and MILL EQUIPMENT NEWS

New Developments in "Pneumafil" Suction Underclearers

The streamlined collector units in this latest system are fitted with a new direct drive 1½ h.p. unit consisting of a special built-in motor and a new high duty impellor

THE "Pneumafil" Division of Carrier Engineering Co. Ltd. have designed a completely new type of "Pneumafil" for high speed modern spinning frames now being installed in Lancashire.

The new "Pneumafil" (Fig. 1) is available for all drafting conversions and can be fitted to existing frames. The streamlined collector units are fitted with a new direct-drive 1½ h.p. unit, consisting of a special built-in motor and new high duty impellor.

There is complete access for the recovery and easy removal of waste through special flush-fitting doors. The phosphor bronze waste collecting screen is of a flattish design, minimising the effect of rat-tailing in the collecting units. The air discharge from the units on the new ringframes is downwards, and assists in the dissipation of the frame drive motor heat.

The main "Pneumafil" aluminium ducting is Pyluminised after manufacture, a finish which gives protection against corrosion. Waste fibres passing through this ducting polish the Pyluminised finish and give a highly glazed finish inside the ducting. There is no likelihood of any accumulations or stoppages occurring in this specialised ducting.

Flute connections into the main duct are now made by a new flexible rubber spigot which allows sufficient depressibility for the flutes.

The broken end collecting tubes are a new design (Fig. 2). The pear-shaped flute has a flat top giving added strength, and into this flat top are inserted suction nozzles fixed to a Carrier patented design.

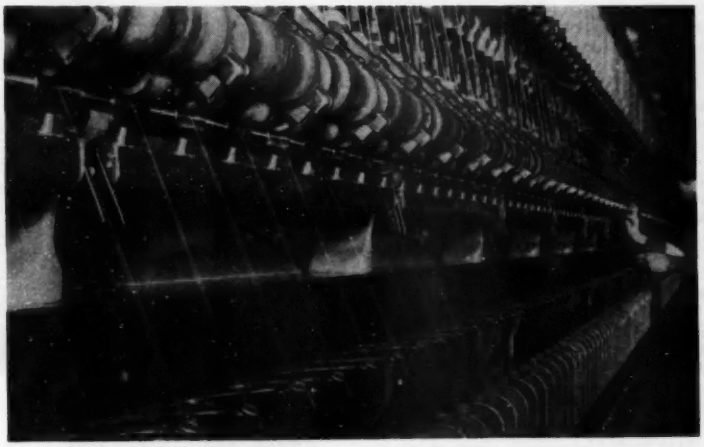


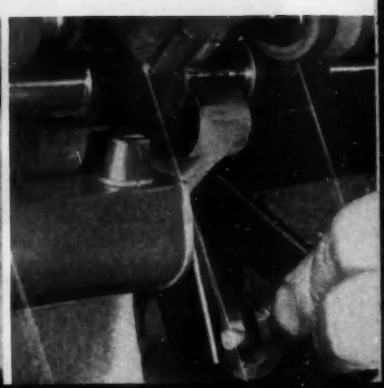
Fig. 1. Ringframe fitted with "Pneumafil" and secondary cleaners ("Pneumaroll") illustrates perfect alignment of new nozzle/flutes

The tubes are pyluminised and thermo-dip painted to the usual "Pneumafil" high-grade finish, and the nozzles match the gauge of the spindles to which they are to be fitted.

The metal end plugs of the flutes are now fitted with straight pins to support them in the new patented suspension brackets. These end plugs are so designed to accommodate small springs at each end for the support of a secondary underclearer, when the new standard "Pneumafil" is required to be converted to "Pneumaroll (Fig. 3).

In the past, "Pneumafil" flutes have been supported either by normal underclearer springs or by gravity weight brackets supplied by the frame makers, and they have been apt to get out of position. This has been completely over-

(left) Fig. 2. The broken-end collecting tubes are of completely new design
(centre) Fig. 3. This view shows the new patented support brackets
(right) Fig. 4. The flute drops to non-working position on lifting the latches of these brackets



come by the new Carrier patented gravity-type brackets fastened to the stands. These support brackets retain the "Pneumafil" flutes exactly in position until such time as the operative wishes to depress them.

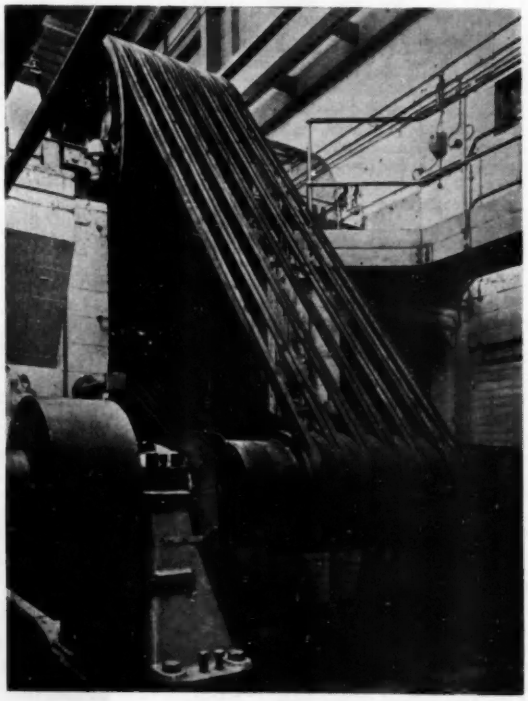
By lifting the latches of the brackets (Fig. 4) the flute drops to a non-working position, and leaves the operative with both hands free.

The nozzles of the flutes are independently replaceable, and therefore piking in the mills by careless operatives no longer means that the whole flute is spoiled, because the nozzles can now be replaced separately. The new type nozzle/flutes permit the operative to see under the drafting gear in the case of "Pneumafil." In the case of "Pneumaroll" it permits her to see that her secondary under-clearers are always rotating properly. The open space between the nozzles permits overhead travelling fans to inject air under the drafting system, whereas with the previous solid flutes or the continental pear-shaped flutes this was not possible.

"Terylene" Reinforced V-Belts

"TERYLENE" reinforced V-belts, now available from many leading manufacturers, are already in use in widely varying conditions—from ½ h.p. machines up to 600 h.p. compressors. Because "Terylene" is so strong it has often been possible to use fewer individual belts on existing drives, while future drives designed to incorporate fewer belts, may mean considerable savings in space and money.

At Glacier Metal Co. Ltd., pulley speeds up to 6,000 r.p.m. and oil vapour temperatures of 180°F. meant that standard belts were continually having to be replaced, but "Terylene" reinforced V-belts, said to last three times as long as standard belts, have been installed on 21 test heads. Jaguar Car Co. are reported to have standardised on "Terylene" reinforced V-belts for all drives in their paint shop and on a 40 h.p. 1,470 r.p.m. turbo blower at the Trafford Park Works of British Oil and Cake Mills, "Terylene" reinforced V-belts are claimed to have lasted 14 months compared with three to four months for standard belts.



"Terylene" reinforced premium V-belts made by Turner Bros. Asbestos Co. Ltd., installed on a 600 h.p. compressor at a chemical works in N.E. England

Conveying Boiler House Smalls

A NEW high speed screw elevator is the latest development announced by James Hodgkinson (Salford) Ltd. It has been designed primarily for handling boiler-house smalls where for one reason or another it is not convenient, or possible, to prepare a concrete ground hopper or pit. It is said to be ideal for feeding the hoppers of "Low Ram," chain grate or underfeed stokers.

The elevator consists of a steel tube in which rotates a worm housed in totally sealed, self-aligning ball bearings and driven by a constant speed, totally enclosed motor mounted on a platform at the head of the casing. A short standard chute extends from the head to which an additional section or breeches piece can be added, provision being made for this to be swivelled to suit site conditions. At the tail the worm is exposed for the entry of coal. An adjustable device enables the head to be supported from any convenient structure in the boiler-house.

Each unit is claimed to handle up to 1½ tons of smalls per hour and feed direct to the stoker simply by resting the tail on a pile of coal and lifting the head into position over the stoker hopper. The elevator is entirely self-cleaning and no running maintenance is required since the bearings are grease packed and sealed for life. The machine which can be working within half an hour of delivery, is supplied in the following standard lengths: 13, 14, 15, 16, 17, and 18 ft.

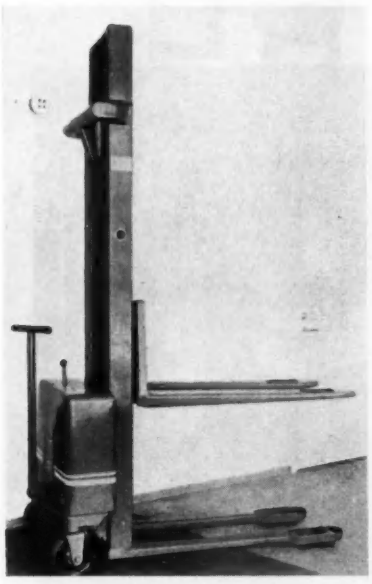
Pedestrian Operated Electro-Hydraulic Stackers

AN interesting new range of stackers designed and produced in Sweden is now available in this country. Known as the BT SV stackers, they are pedestrian operated with an electro-hydraulic lift and have a capacity of 1,100 lbs. or 2,200 lbs. at a 24 ins. load centre. Standard lift heights of 92, 108, 124 or 132 ins. are available. These trucks are excellent for operation in confined spaces as they have a turning radius of only 69 ins. and an overall length of 63 ins. including forks. BT stackers are particularly suitable for use where floor loading is restricted having an unladen weight of less than 900 lbs.

Maximum rigidity and strength under full load is achieved by virtue of the fact all main components such as mast, lifting forks, mast channels, and support legs are one-piece pressings of high tensile steel. The hydraulic unit is completely leak proof incorporating special packing material which provides long and trouble-free service. Lifting speed is 33 f.p.m. with the half-ton model and 16 f.p.m. with the one-ton model. The lowering speed is adjustable. Single, telescopic and free lift masts can be supplied.

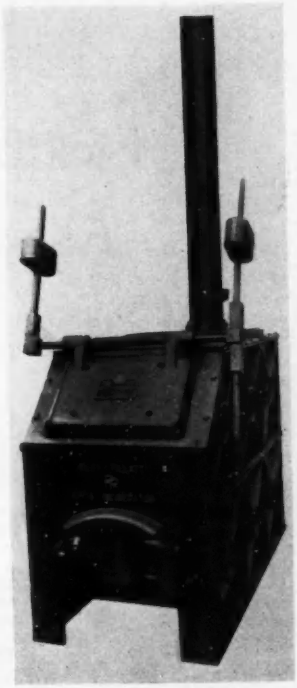
Free of complicated mechanisms coupled with clean styling make routine maintenance negligible. Wear in the lifting assembly can be taken up by simple adjustment of the carriage brackets and mast channel guides. Mains operated models are available as an alternative to the battery powered units and stackers with a manually operated hydraulic system can also be provided.

The small initial cost of BT stackers and the low operating and maintenance charges ensure maximum economy in the movement of materials. Good manoeuvrability and effortless operation is provided through the fitting of SKF bearings and nylon reinforced bakelite wheels resulting in increased labour efficiency. Full details are available from the U.K. distributors, Rolatruc Ltd., 20 Old Compton Street, London, W.1.



Designed and produced in Sweden, the BT SV stacker has a turning radius of only 69 ins. and weighs 900 lbs., an important feature where floor loading is restricted

Efficient Disposal of Refuse



RILEY (IC) Products Ltd. recently acquired the manufacturing rights for the Pillatt incinerator, now marketed as the Riley-Pillatt incinerator. Already well established in its field this incinerator is widely known for its efficiency, safety and hygienic operation; its design is the result of 30 years' practical experience.

The disposal of refuse accumulated during a normal day's work has always presented difficulties in factories, warehouses, hospitals, blocks of flats and other premises, especially as its collection and transportation is often both expensive and inconvenient, and in these instances the incinerator is particularly valuable.

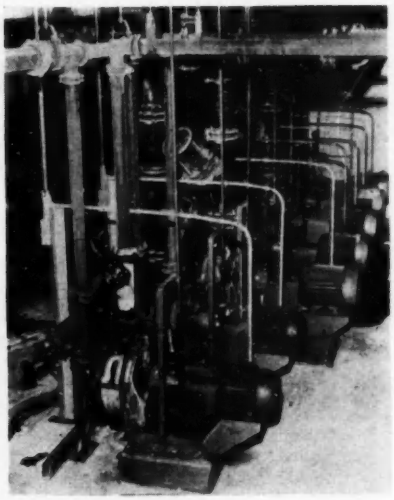
The advent of the Clean Air Act precludes the use of open bonfires and primitive destructors for burning waste but because combustion in a Riley-Pillatt Incinerator is virtually smokeless when the usual forms of general refuse are being burnt, it thus fulfills the new demands of the Act.

The incinerators are encased in cast iron and can be positioned in the open or under cover. Two important features are the controlled openings for the admission of secondary air and a baffle chamber designed to direct the waste gases downwards over a water seal before entering the flue. A mild steel chimney is generally supplied with each unit but it can be connected by smoke piping to an existing flue or chimney. Further details may be obtained from Riley (IC) Products Limited, 19 Woburn Place, London, W.C.1.

New Flanged Flow-Sights

LIQUID Systems Ltd., Holmethorpe Avenue, Redhill, Surrey, recently increased the range of their well-known flow indicating and control instruments to include flanged versions as well as screwed. They are now available up to 6 in. nominal bore. The illustration of the Model LS. 150 3 in. angled gravity flow-sight shows two plugged inlets available for either thermometer, vent or vacuum line connections as may be required. Model LS. 140 is the straight version. All instruments are made in acid resisting bronze and are also available in cast iron, steel or stainless steel.

Pumping Hot Acids for Rayon Production



THE bank of corrosion-resistant centrifugal pumps shown in this photograph—part of a group of 80 such units—is but a portion of one of the largest installations of impervious graphite processing equipment in the world. Circulating hot, dilute acids in the treatment of rayon staple fibres, the pumps were installed at the rayon staple plant of American Enka Corporation, Lowland, Tennessee, U.S.A., on the basis of operating performance and low maintenance of similar units in service at other American Enka plants. Other Karbate impervious graphite processing equipment, available from Union Carbide International Co., Division of Union Carbide Corporation, in use at the Lowland plant includes heat exchangers, and spin-bath evaporator tubes.

Correct Seating Assists Productivity

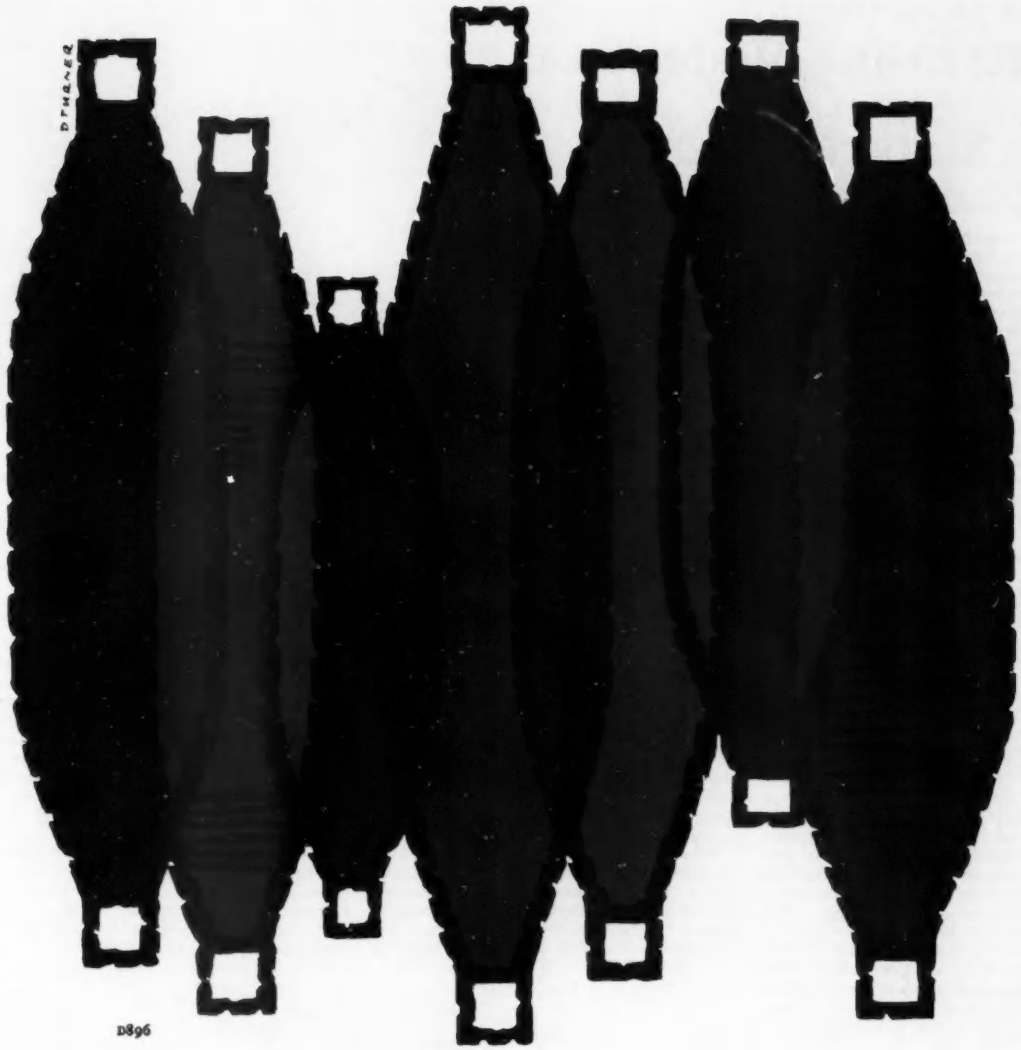
IF workers on assembly lines were seated at the correct height, productivity could increase in some cases by as much as 5%. This was one of the conclusions in a survey conducted on behalf of General Trade Equipment, Seymour Place, London, W.1. The company now market what is claimed to be the cheapest factory seat in the world, and it is made in six different heights, ranging at 2 in. intervals from 20-in. to 30 in. Made of strong 1-in. angle and strip steel, the seats are smartly finished in silver cellulose. They have pliable backs and seats of vulcanised fibre. The non-scratch metal feet can, if so wished, be screwed into the floor for added safety.

Flexible Storage Arrangements

WHEN William Hollins and Co. Ltd., textile manufacturers and makers of the "Viyella" range of fabrics and clothing, installed extra shelving to store boxes of finished garments at their Nottingham warehouses, their future needs were not precisely known. The racking had to be adaptable enough to enable considerable modification or extension, should the need arise. Using Dexion slotted angle, 6 ft. high storage units divided into 3 ft. square compartments were erected in such a way that extra shelves could be added on top with a minimum of time and trouble.

Now the firm has decided that, for ease of handling, the Dexion will be altered to make more compartments, each being only a quarter the area. Garments are to be stored loose in hardboard trays instead of in boxed quantities. Dexion is extensively used in the textile field in Britain and the Continent because its versatility enables it to be modified to suit the industry's changing requirements.

Dexion racking used to store goods at William Hollins and Co., Ltd., makers of the "Viyella" range of fabrics and clothing



ICI processing aids for viscose rayon

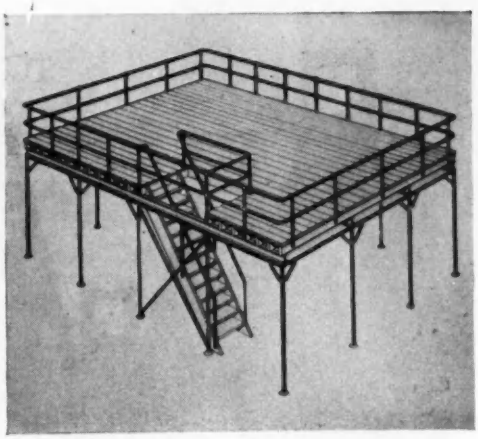
Continuous Filament:	LISSAPOL N CALSOLENE OIL HS	for rapid wetting
	LISSAPOL NX LUBROL MOA	for self-scouring lubricants: avoid scouring before dyeing
	CIRRASOL XL CIRRASOL SB	for softening
	CIRRASOL SF	for scrooping
Staple Fibre:	CIRRASOL FP CIRRASOL SF CIRRASOL AR LUBROL MOA LISSAPOL NX	for lubrication, anti-static protection, improved fibre control in carding and spinning
	CIRRASOL FP CIRRASOL SF	for scrooping
	CIRRASOL XL CIRRASOL SB	for softening

I.C.I. Technical Information (Dyehouse) Leaflet No. 453 gives full details
Copies available on request.

IMPERIAL CHEMICAL INDUSTRIES LIMITED LONDON SWI ENGLAND

Increasing Warehouse Storage Capacity

IN many warehouses the floor area becomes congested, yet the overhead space is unoccupied. This is where the T.C.S. (Tubular Construction Systems Ltd., 135 Battersea High Street, London, S.W.11) storage floor can increase storage capacity without any building or structural alterations being involved. T.C.S. storage floors, fitted over rolled steel or tubular joists supported on tubular steel stanchions, form a strong construction which will carry loads up to 300 lbs. or more per sq. ft. depending on the type of floor installed. Being independent of the building, they can be constructed to any desired area, or erected along walls, etc., the height of the floor being determined by the space available overhead.



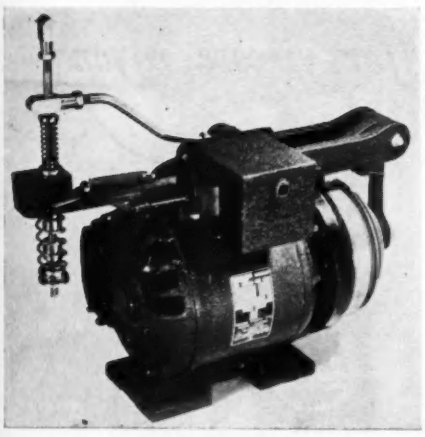
Independent of the building, T.C.S. floors can be constructed in any available area, the height of the floor only being limited by the space overhead

T.C.S. storage floors are fitted with either tongued and grooved boards or wooden slats, on joists, similar to normal flooring. They can also be fitted with hand rails, staircases, gravity conveyor, etc., as required. Rapidly assembled, approximately 250 sq. ft. per day, they are easy to extend, alter or dismantle and embody the modern tubular construction.

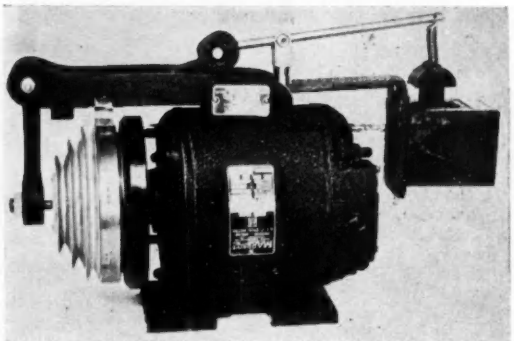
New Controls for Clutch Motors

PRODUCTION processes where clutch motors are used can now be made automatic, or semi-automatic, by the addition of two new controls developed by Marine Engineering Co. (Stockport) Ltd. With all Mardrive clutch motors, the heavy, dynamically-balanced flywheel is fixed positively to the rotor shaft of the motor, which runs continuously. The clutch engages with the face of the flywheel as and when the drive is required. When the clutch is released, the brake comes into operation immediately and stops the driven machines almost instantaneously.

Where compressed air is available, an air cylinder is fitted to the clutch motor which can be controlled by trip-valve or similar device. Alternatively, the clutch motors can be operated electrically, using a solenoid controlled by a micro-limit or time-switch depending on the sequence of operation. The semi-automatic control was designed originally for coil-winding and similar machines where a gradual acceleration of the driven machine is required. The clutch is engaged gradually by hand or foot control and once the speed of the driven machine is reached, it is maintained at this speed by a spring-operated latch. This latch is connected mechanically to a solenoid. When the solenoid is energised, it trips the latch, releases the tension on the operating lever and the brake is applied, stopping the machine.



The Mardrive clutch motor with hand-controlled engagement and automatic clutch release



The Mardrive clutch motor has solenoid actuation for remote control

Large Order for "Unifil" Winders

According to a recent report from America Mr. R. M. Cushman (executive vice-president, Amerotron Company) has placed an order for 3,200 "Unifil" loom winders with Mr. F. P. Barrie (Southern district manager, Leesona Corporation). Mr. Cushman stated that he purchased these because "Unifil" winders already installed in Amerotron plants had shown quality improvement on some of their fabrics. He also said: "We have been able to run more fabrics through the use of 'Unifil' and have made available more floor space by eliminating conventional filling preparation equipment."

THE TEXTILE
COLOURIST & FINISHER

Catalysts for Crease-Resistance

There is no straight and simple path through the maze of complications confronting the finisher who is seeking the "best" catalyst

By J. T. MARSH

THE original idea of catalysis is very old, being associated with the philosopher's stone, but a more modern concept is that of a compound whose mere presence produces reactions which do not otherwise occur; a very slight trace of the catalyst is sufficient and it is not itself changed during the reaction.

The famous definition by Ostwald placed an emphasis on the rate of reaction, "a catalyst is a substance that changes the velocity of a chemical reaction without itself appearing in the end products." It was also shown by Ostwald and Arrhenius that the catalytic constant of an acid was proportional to its equivalent conductivity and they concluded that with acids, the hydrogen ion was the only active catalyst.

A broader picture was presented by Bronsted and Lowry in 1923 for they extended the old idea of an acid being a compound that dissociated in solution to give hydrogen ions, and suggested that an acid was a compound that can lose a proton. As free protons probably never occur in solution as the solvent acts as a proton acceptor, the hydronium ions was postulated corresponding to the ammonium ion.

Another definition was put forward by Lewis in 1923, and based on the electronic theory of valency; an acid is defined as a compound which can accept a pair of electrons from a donor substance, namely, the base. Many salts such as $AlCl_3$ can act as "Lewis acids," i.e. acceptors of pairs of electrons as in contact catalysis.

It is sometimes stated that a catalyst lowers the activation energy of the system so that more molecules have sufficient energy to react and hence the reaction proceeds more rapidly. However, there is no single theory of catalysis which can be accepted as satisfactory; there are similar difficulties in connection with the definition of an acid. We may know how to measure these things but we do not understand them.

One problem has been in connection with the strength of the so-called strong acids which appear to be of equal strength in aqueous solution. From experiments in glacial acetic acid, however, as shown by the work of Kolthoff and Willman (J.A.C.S., 1934, **56**, 1007) it is possible to arrange several of these "strong" acids in order of decreasing strength, $HClO_4$, HBr, H_2SO_4, HCl, HNO_3.

The concentration of hydrogen ions in aqueous solution is generally expressed in terms of pH, suggested by Sorensen in 1909 as the negative logarithm of the molar concentration. At this time it was thought that strong electrolytes, like HCl, were only partly dissociated even in dilute solutions, but it now appears that they are completely dissociated, so that the pH scale is not absolutely satisfactory.

In connection with the use of catalysts in the crease-resisting process there are also many misunderstandings. For example, it is often assumed that only acids or acid-forming compounds are used as catalysts; two of the very earliest processes employing phenol-formaldehyde and acetone-formaldehyde respectively, used sodium hydroxide and sodium carbonate, and even more recent development with dichlorpropanol or with divinyl sulphone utilise alkaline catalysts.

Many investigators appear to have assumed that the embrittlement of cotton in the conventional process was due to the use of an acid catalyst at a high temperature; they seem to have neglected several considerations, such as the fact that the tensile strength of rayon is improved, even though that of cotton is somewhat diminished, and furthermore, these effects are also to be seen in products from those process mentioned above and which employ alkaline catalysts.

Direct evidence of the lack of chemical degradation was provided by Marsh and Wood in 1932 when they showed that the removal of the amino-aldehyde resin restored the original physical properties of the material. This was examined in greater detail by Tankard in 1934, when measurements of solubility numbers showed that the original values were obtained after resin-removal. The restoration of physical properties has since been confirmed by many workers, including Nickerson (Am. Dyes. Rep., 1950, **39**, 446) and Nuessle, Fineman, and Heiges (Text. Res. J., 1955, **25**, 24).

Fear of chemical attack probably accounts for the wrong impression that strong acids should not be used as catalysts.

It may well be that this idea accounts for some of the apparent confusion between strong acids and weak acids, and between mineral acids or inorganic acids and organic acids; it sometimes appears that investigators have given a wrong impression, for some inorganic acids

are weak acids and some organic acids are strong acids.

One of the differences in the behaviour of strong and weak acids may be seen in the relation between concentration and pH as shown in the table.

Concentration and pH

	0·1 N	0·01 N	0·001 N
Acetic acid ..	3	3·5	4
Hydrochloric acid ..	1	2	3

With acetic acid, and many other weak acids, the effect of a ten-fold dilution is to alter the pH value by 0·5, whereas with the strong acid the effect of concentration is much greater for the ten-fold dilution increases the pH by 1.

It may also be of interest to tabulate the pH of decinormal solutions of some of the acids which have been suggested from time to time.

pH of Decinormal Solutions

Hydrochloric acid	1·1
Sulphuric	1·2
Phosphoric	1·5
Oxalic	1·6
Tartaric	2·2
Formic	2·3
Acetic	3·4
Boric	5·2

The strengths of acids and bases, as distinct from their concentrations, are often defined by their dissociation constants which may be obtained by conductivity measurements. The constants may be given in terms of pK, and by analogy with pH, pK = — log. K.

Values for some of the acid catalysts which have been put forward from time to time are given in the following table.

Dissociation Constants

	pK	pK_2	pK_3
Oxalic acid ..	1.23	4.19	
Maleic	1.93	6·59	
Phosphoric ..	2·12	7·21	12·30
Malonic ..	2·85	5·66	
Tartaric ..	2·98	4·34	
Fumaric ..	3·03	4·54	
Citric	3·04	4·57	5·87
Malic	3·40	5·26	
Formic ..	3·75		
Succinic ..	4·18	5·60	
Acetic	4·75		
Boric	9·24		

Quite a variety of compounds has been suggested as catalysts in the crease-resisting process and some rather extraordinary claims have been made from time to time. One ever-hopeful investigation has been the attempt to find a catalyst which will give good results on cotton without affecting tensile or ripping strength; it does not seem to be appreciated that many physical properties of the treated goods are inter-related to such an extent that the reduction in strength, for example, is a direct function of the recovery from creasing.

Among the compounds suggested as catalysts at different times, the following may be taken as typical:—

Fatty acids, mineral acids, acid salts.
Ammonium salts, salts of primary amines.
Salts of more complex amines.
Alkanolamine salts.
Polyvalent metal salts.

With all these catalysts, care must be taken to ensure that neither the fabric to be impregnated nor the impregnating solution before the addition of the catalyst, contains alkali the kind and amount of which will reduce the acidity of the catalyst and so interfere with the final condensation. As will be realised this precaution is particularly important when mild acids are used; these, however, are no longer commonly employed.

Free Acids

The first disclosure of a method of making cellulosic fabrics crease-resistant was given in B.P. 291,473.

20 parts of 40% formaldehyde solution
10 parts of urea
5 parts of boric acid
60 parts of water

The fabric was impregnated in this solution at room temperature, dried at 130°C., and maintained at this temperature for 30 mins.

Although this example undoubtedly gave crease-resisting effects, it was not beyond improvement for several reasons; the reagents were uncondensed and gave rise to unpleasant vapours of formaldehyde when the process was operated on more than a laboratory scale. Attention was immediately drawn, in the next few lines of the patent specification, to the possible use of a preliminary condensation product.

Boric acid was soon found to be the source of some difficulty, for the solution was unstable and rapidly deposited a precipitate after a few minutes; the greater part of this precipitate was methylene urea but some of it was boric acid, the solubility of which is only 4%.

Attention was turned to the use of a more stable solution and for some time acetic acid was used as a catalyst. An investigation of a number of organic acids by the writer in 1932 established that tartaric acid was suitable in respect of reasonable stability of the impregnating solution (2 hours or more) and a short time of heating (2 to 3 mins.) at 160°C.

Tartaric acid was also shown to impart good resistance of the resin to washing, compared with the indifferent fastness given by acetic acid or boric acid. It is not always realised, even today, that urea-formaldehyde resinous condensation products are capable of producing reasonably good crease-resisting effects in absence of a catalyst, the most important function of which is to impart a high degree of fastness to domestic washing.

It may be for this reason that Gagliardi (Am. Dyes. Rep., 1951, **40**, 769) found that alkaline substances, particularly $NaHCO_3$, could be used as curing catalysts with urea-formaldehyde; slightly less resin is fixed but both crease-proofing and stabilisation of the fabric were obtained. The whole story may be rather more complicated, however, for it has been suggested by Murakami (Bull. Text. Res. Inst., Japan, 1955, **3**, 65) that there may be a Canizzaro reaction with the production of formic acid, and that the alkaline catalyst is really a latent acid catalyst.

The two main requirements of a catalyst for the crease-resisting process are that it should harden the resin within reasonable limits of time and temperature of heating, and that it should not interfere unduly with the life of the impregnating bath. These requirements are not difficult to fill, being largely a matter of pH, but it is easier to vary time and temperature than to control the life of the bath with free acids.

Tartaric acid was used as a catalyst with pre-condensed solutions of urea-formaldehyde on the works' scale for many years in England and other countries.

The acidity of the solution of urea-formaldehyde in the impregnating bath must be such as to give reasonable stability from precipitation during use and this required a period of three hours or so; on the other hand, the acidity of the condensate must be adequate to ensure proper hardening of the resin within a few minutes at a temperature which is not unduly high (for example, 2 to 5 mins. at 160 to 180°C.). In the manufacture of actual resins, as distinct from their application to textiles, curing is effected at or near pH 5.

Some typical figures for the onset of methylene urea precipitation are given in the following table.

Precipitation of Methylene Ureas

pH	Onset of Opalescence
0·5	5 mins.
1·0	10 "
1·5	15 "
2·0	30 "
2·5	75 "
3·0	120 "
4·0	240 "
5·0	600 "

Some writers have referred to "resin precipitation" when dealing with the cloudiness of the impregnating bath, or in estimating its stability, and seem to be under the impression that the precipitate is that of the urea-formaldehyde resin itself; the actual precipitate is methylene urea which exists in the form of fine discrete particles and is not a resin.

Methylene urea was known long before urea-formaldehyde resins were made; references to the literature include Hoelzer (Ber., 1884, **17**, 659), Tollens (*ibid.*, 1896, **29**, 275), Goldschmidt (*ibid.*, 2439), Einhorn and Hamburger (ibid., 1908, **41**, 24). Dixon (J.C.S., 1918, **113**, 238) has given some interesting information about the precipitation of the methylene ureas from methylol urea solutions; whereas an acidified solution of dimethylol urea may take minutes to precipitate, monomethylol urea solutions only take seconds. Furthermore, a solution of dimethylol urea when acidified will precipitate fifteen times as fast as the uncondensed reagents.

Another important paper on methylene urea has been written by Walter (Trans. Farad. Soc., 1936, **32**, 377) who gave some speculations as to the chemical constitution of methylene urea; this complex matter has received attention later from Becher (Ber., 1956, **89**, 1593). It is possible that methylene urea is mainly as follows:—

$$H_2N.CO.NH.(CH_2.NH.CO.NH)_6 .CH_2.NH.CO.NH_2$$

The stability of dimethylol urea over monomethylol urea has been explained by Hultzch (Angew. Chem., 1949, **61**, 946) on the basis of his theory of resinification by proton bridges; monomethylol urea forms a six-membered ring structure, whereas dimethylol urea forms a more stable eight-membered twin ring structure (Fig. 1).

The deposition of methylene urea was made the basis of a delustring process by Foulds and Marsh in B.P. 467,480 and has been described along with other delustring processes by Marsh (Introduction to Textile Finishing ; Chapman and Hall ; London; 1957).

B.P. 562,790 of Courtaulds appears to attach some importance to mixtures of boric acid and tartaric acid (1 : 4); special claims have been made by Farberei Sitterthal in B.P. 456,307 for organic acids with high melting points, e.g. malonic or succinic acid.

It has also been suggested (e.g. USP. 2,484,598-9) to conduct the final condensation in presence of the vapours of a volatile acid.

Before leaving consideration of the free acid as a curing catalyst, mention may be made of a method described by Daul, Reinhardt and Reid (Text. Res. J., 1952, **22**, 792) and which depends on the introduction of carboxyl groups into the cellulose of cotton or viscose rayon to produce an internal or "built-in" catalyst for the final condensation of the resin; this may be accomplished by carboxymethylation using chloracetic acid and sodium hydroxide. The usual catalyst is thus unnecessary and the product gives good crease-resistance and fixation of the resin. This is an extremely interesting suggestion, if a little expensive compared with conventional treatment; one wonders, however, if a carboxymethyl cellulose which is sufficiently acidic to act as a curing catalyst for urea-formaldehyde, would not in itself be subject to autohydrolysis and therefore be stabilised chemically as well as physically by the internal formation of the synthetic resin.

In addition to the use of the free acid as a catalyst, it is also possible to employ certain acid salts, such as sodium hydrogen sulphate or sodium dihydrogen phosphate; the latter gives a pH in the region of 5, and requires a temperature of 160°C. or so for efficient curing in a short time of about 3 to 5 mins.

There have also been attempts to use buffered solutions of urea formaldehyde, presumably in the hope that such a solution might give less embrittlement than unbuffered solutions. B.P. 618,184 of the Linen Industries Research Association makes use of a mixture of citric acid and disodium hydrogen phosphate (1 : 2) to maintain the acidity substantially constant at pH 4 both during drying and the final heating.

Other investigators have tried various buffer solutions in the catalysed pre-condensates without the appearance of any substantial advantage, no doubt some of these suggestions arose from attempts to prevent the fall in pH and so (mistakenly) avoid the acid hydrolysis of the fibre.

Latent Catalysts

The use of latent catalysts is described in B.P. 449,243 of Battye, Marsh, Tankard, Wood and Watson of Tootal Broadhurst Lee Co.; the specification also gives methods of preparing pre-condensates or reaction mixtures.

Broadly speaking, the latent catalyst is one which does not produce the desired acidity until required, i.e. until the stage of curing or final heating of the resin; thus, one may have an impregnating solution which is alkaline (or only slightly acid) and becomes acid during the drying and/or heating stages of the process. In this manner one may envisage an impregnating bath which is quite stable and does not deposit methylene ureas.

Good examples of latent catalysts which prolong the life of the impregnating bath are ammonium salts such as ammonium tartrate, citrate, formate, acetate, oxalate and so forth; under comparable conditions, an impregnating bath containing 7·5 grams per litre of tartaric acid was stable for 5 hours whereas the equivalent quantity of ammonium tartrate imparted a stability of 30 hours. The manifold increase in stability is an important improvement in works' practice not only in itself but also because it permits the addition of greater amounts of acid in the form of the ammonium salt than as free acid should this be required.

The technique of the latent catalyst, however, was extended further in the same patent, for it enabled strong acids to be used in this manner whereas in the free state the stability of the bath would be less than ten minutes. The use of stronger acids than those previously employed enabled the final condensation to take place at a lower temperature or in a shorter period of time (130 to 140°C. instead of 160 to 170°C.).

Suitable catalysts are the ammonium salts of sulphuric, hydrochloric, nitric and phosphoric acids; ammonium phosphate is of particular interest on account of the monobasic, dibasic, and tribasic salts with their different behaviour in aqueous solution. Other ammonium salts mentioned specifically are ammonium ethyl sulphate, and ammonium oleyl sulphate or sulphonate.

All ammonium salts decompose as the temperature of their solutions is raised, but in addition such com-

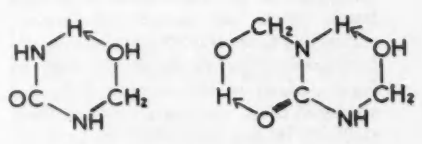


Fig. 1

pounds also liberate acid by reaction with the methylol groups of the urea-formaldehyde pre-condensate and/or any free formaldehyde which may be present or produced. This is an important point, for if the ammonium salt is added to an uncondensed mixture of urea and formaldehyde, its acid is liberated almost at once; in these circumstances there is little advantage in the use of the ammonium salt over that of the free acid.

Ammonium dihydrogen phosphate, $NH_4H_2PO_4$, was found to be particularly suitable in practice, for although its solution is slightly acid yet the stability of the impregnating bath is quite adequate for works' usage, and the salt is readily decomposed to the free acid during the drying operation. Should an alkaline bath be required for even greater stability, then triammonium phosphate $(NH_4)_3PO_4$ may be used, but the world-wide employment of $NH_4H_2PO_4$ at different times points to its all-round efficiency. Diammonium phosphate enjoyed great favour in the U.S.A.

Care must be taken in considering the amount of catalyst when dealing with the strong acids; obviously an insufficient quantity will not harden the resin to the required extent, but an excessive amount is perhaps equally dangerous for there is a possibility of acid hydrolysis of the resin produced. With weaker acids and their salts, a slight excess is not so dangerous. B.P. 449,243 generally deals with reaction mixtures which contain about 60% of solids as prepared and before dilution; the amount of ammonium dihydrogen phosphate is expressed as 2 to 3 g. per 100 cc. of concentrated mixture which corresponds to 3 to 5% of the solid in that mixture. The actual impregnating bath is obtained by diluting the original concentration to 50% thus giving 1 to 1·5 g. of catalyst per 100 cc. or 10 to 15 g./litre (Fig. 2). This method of estimation may be all very well for certain solutions but may be most misleading for others; grams per litre may give an insufficiency or an excess of catalyst according to concentration.

The technique of the latent catalyst is not confined to ammonium salts, for reference is made in the patent specification to compounds of similar bases such as monomethylamine, dimethylamine, the ethanolamines, the hydrazines, cyclohexylamines and so forth. Many of the organic bases are stronger than ammonia so that their stability in the bath may be greater, but on the other hand, they do not

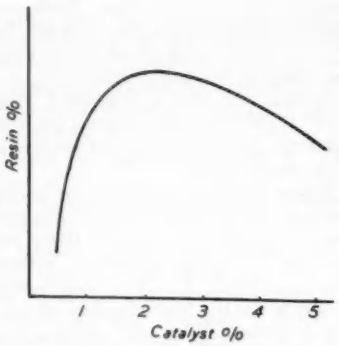


Fig. 2. The effect on the amount of added resin of ammonium phosphate catalyst, estimated on 60% resin solution

decompose so readily and may require a slightly higher temperature or longer time of heating; indeed, some organic bases are more alkaline than sodium hydroxide itself and the salts of such strong bases would be of little or no value as potential acid catalysts.

There seems to have been some misunderstanding about the use of ammonium thiocyanate which was described as "unsuitable" in B.P. 449,243; several writers have assumed this to mean that NH_4CNS is ineffective. In actual fact, the catalytic action is good, but there is always the danger of traces of iron producing discolouration through the formation of the blood-red ferric thiocyanate; this may be a nuisance, not only as a result of the actual treatment, but may arise later when unwashed goods come in contact with the needles of sewing machines. In B.P. 579,709, there is suggested the use of ammonium thiocyanate as a catalyst in conjunction with a sequestering agent for iron, such as Calgon.

Otherwise, ammonium thiocyanate acts very efficiently as a catalyst as shown by Smith (J.S.D.C., 1954, **70**, 381) and in many respects is superior to diammonium phosphate; the reason for this is not clear, but it may well be that in addition to accelerating the reaction, it also enters into combination with the amino-aldehyde condensation product. Good results have been obtained with 1% of NH_4CNS estimated on the solids content of the impregnating solution.

In Germany the use of ammonium nitrate as a potential acid catalyst is very popular; according to D.B.P. 902,003 (filed in December 1939) there are certain advantages in employing the ammonium salts of inorganic acids which possess oxidising powers, e.g. nitrate, persulphate, chlorate, or perchlorate. It is stated that they permit the final condensation of the urea-formaldehyde resin to take place at 100°C., so that it is not necessary to employ a special chamber for curing, but only the usual steam-heated cylinders or a stenter. In an example, the amount of ammonium nitrate is 2·5 g./l. with 150 g. of dimethylol urea; impregnation takes place in the usual manner followed by drying at 100°C. on cylinders or stenter.

Ammonium nitrate had previously been suggested in B.P. 460,201, along with other oxidising compounds such as acids and their salts, as a catalyst for the reaction between cellulose and formaldehyde.

In the U.S.A., special attention appears to have been directed to the use of alkanolamine salts as catalysts; many of these are mentioned in B.P. 660,366; 697,479; 672,130 and 705,608 of Monsanto. Some of the examples have achieved wide usage, namely, triethanolamine hydrochloride, and the hydrochloride of 2-amino-2-methyl-1-propanol, the latter being well-known as Catalyst AC. The phosphate of 2-aminobutanol also deserves mention.

Catalysts of this type do not decompose or hydrolyse in water like ammonium chloride or zinc chloride, and the aminoaldehyde solution will remain clear for 18 hours in their presence compared with 2 hours with zinc chloride. Even at moderately high temperatures of the impregnating bath, e.g. 40 to 45°C., they give a stability of about 8 hours, compared with 5½ hours of ammonium phosphate; some of the catalysts enable the pH of the impregnating bath to be as high as 8 or 9. Another advantage of these special alkanolamine salts is that they are less likely to produce a fishy smell than is the case with the ammonium salt catalysts when they are misused.

The optimum concentration of Catalyst AC is 1% in the impregnating bath corresponding to about 5% on the solid content of the bath; curing requires the usual conditions of time and temperature for strong acid datalysts (about 150°C. being advisable) when the results obtained for recovery, strength, shrinkage and resin retention are fully equal to those obtained with other catalysts. The AC catalysts are generally used in 5% concentration on the resin solids, where about 3% of diammonium phosphate would be similarly employed.

In addition to catalyst AC, there are also AC2, AC4 and AC6 but the last two are not recommended for the simpler melamine formaldehyde con-

densation products. Catalyst AC2 is marketed in 50% concentration and the others in 35% strength; the pH of their solutions lies between 7·7. AC6 is the most active of the series, but the bath-life is shorter and the final product may be slightly discoloured.

The chief reason for the move towards the "amine" catalyst, as distinct from the ammonium salt, was connected with the possibilities of the latter producing a fishy odour in the treated goods after storage, as discussed by Nuessle, Heiges and Olney (Text. Res. J., 1949, **29**, 41) and also by Marsh (Text. Rec., 1958, **75**, 85). The trend towards an ammonia-free system is not fully justified for the amino-aldehyde compounds themselves may produce fishy odours in certain circumstances; there are many finishers who have used the ammonium salt catalyst for over 25 years without any trouble whatsoever. There is much to be said for the careful finisher, as distinct from the care-free catalyst which may lead to careless treatment.

Other bases have been used to form "amine" catalysts but they do not seem to have become popular, e.g. carbazide and pyridine. Triethanolamine hydrochloride is encountered occasionally but there seems to have been rather more success with the trialkylamines which have been suggested for use in combined finishes, i.e. the crease-resisting finish along with water-repellency in one process, where great care is needed.

Pyridinium salts have also been utilised as catalysts and their application probably arose from consideration of combined finishes; with urea-formaldehyde and Velan, for example, the latter can act as the catalyst as well as the shower-proofing agent or softener.

The technique of delayed catalysis has been of very great value in enabling finishers to employ strong acids under conditions where the free acid would be unsuitable; with the acid catalyst, as has been demonstrated, there is some competition between hydrolysis and condensation, hence it is unwise to have free strong acid in the impregnating bath even of those compounds which do not precipitate in presence of acid, e.g. DMEU, although some of the amino-aldehydes have good buffering powers. During drying and heating, however, there is an increase in viscosity so that the acid may well be confined and prevented from attacking the cellulose.

Before passing to the consideration of metallic salts, mention should be made of a few minor ideas in connection with delayed catalysts.

The suggestion has also been made, for example by Foulon (Bekleidung und Wasche, 1955, **7**, 197) that acid methyl pyrophosphate would be a suitable catalyst for melamine-formaldehyde. Certain catalysts of this type have been used for stoving enamels, but as they tend to hydrolyse rather rapidly in water, they would seem to have inherent disadvantages as latent catalysts for aqueous solutions of amino-aldehydes.

Another idea is the addition of hydrogen peroxide, or a similar compound, to the impregnating solution in the hope of effecting delayed catalysis; as the treatment proceeds, the formaldehyde present is oxidised to formic acid at the higher temperature and the acid brings about the necessary condensation of the amino-aldehyde product. Although this has been mentioned in two patents, B.P. 482,254 and 720,016, it does not appear to have been widely applied in practice.

B.P. 682,677 mentions a somewhat different type of latent catalyst depending on the production of two protolytic systems of conjugate pairs of acids and bases; guanidine carbonate and ammonium persulphate together form a tlaten catalytic system.

(*Concluded in next issue*)

Trade Literature

NYLON-CORDED TYRES. A booklet recently published by British Nylon Spinners Ltd. quotes the actual experience of a number of British users. The stories, powerful praise for nylon, are based on the experience of heavy transport operators. Their attractions are also great to the man who has a high-powered car which he drives hard. With the coming of the motorways, faster acceleration and more powerful brakes, the strain on tyres is constantly increasing. This interesting booklet tells what nylon-corded tyres are achieving and explains how they do it.

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NICKEL ALLOYS *v.* CAUSTIC ALKALIES. Henry Wiggin and Co. Ltd., Thames House, Millbank, London, S.W.1. This revised publication provides extensive data on the performance of nickel and high-nickel alloys in a variety of plant processes. Included in the review of industrial applications of these alloys are caustic soda manufacture, viscose rayon, pulp and paper, soap manufacture and petrol refining. This informative publication is free on request.

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GOOD PRACTICE IN THE FIRE PROTECTION OF BUILDINGS. Fire Protection Association, 31 - 45 Gresham Street, London, E.C.2 (price to non-members: 2s.0d.). In this booklet the subject of structural fire protection is dealt with in two sections. One discusses general principles of fire-resisting construction and the part that layout and sub-division of buildings can play in the promotion of fire safety. The other discusses the application of fire protection principles to individual elements of structure and recommendations are given for the fire-resistance required for various structural elements.

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RIGIDEX POLYTHENE. The impact now being made on modern industry by the introduction of Rigidex high density polyethylene is well demonstrated in a new publication issued by British Resin Products Ltd., Devonshire House, Piccadilly, London, W.1. Entitled "Rigidex—the polyethylene plus"—the booklet outlines the increasing use of Rigidex in many different industries and shows how its properties are making more things possible in plastics.

• • •

EXPORTING TO THE MIDDLE EAST. Board of Trade, Directories and Notices Section, Room 0348, Horseguards Avenue, Whitehall, S.W.1. Pointing out the importance of Middle East markets to the British exporter, this recently released sixteen-page booklet reviews in an expert and concise manner the size and general background of the Middle East market, distribution of trade, goods bought from the U.K. and foreign competition. Sections are also included on the principle markets, the Advisory Council on Middle East trade, and advertising.

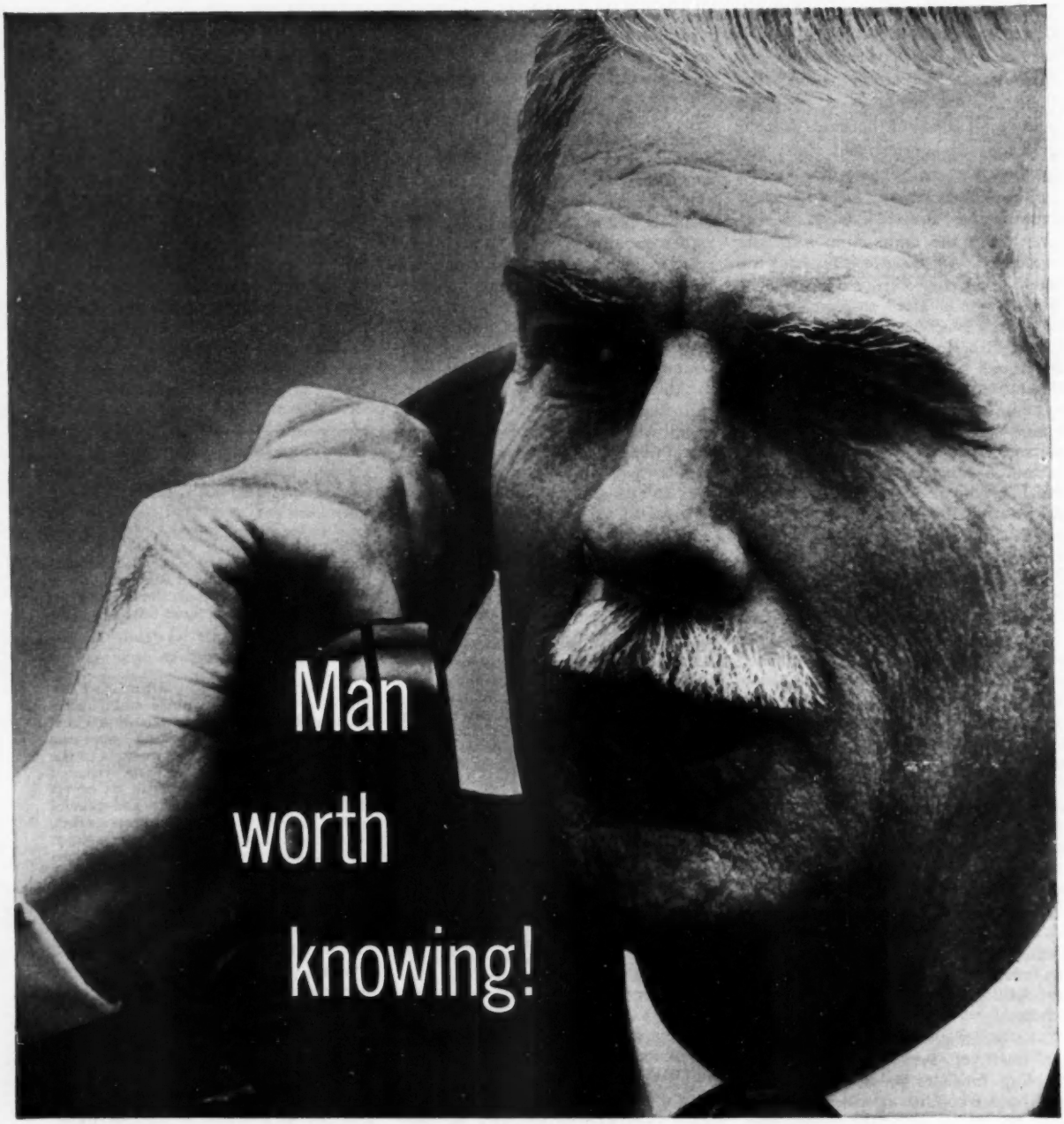
• • •

DETERGENTS. Cyclo Chemicals Ltd., Manfield House, Strand, W.C.2, have produced two new technical bulletins on detergent manufacture entitled "Make your own synthetic detergent at half the cost with Cycloryl ABSA" and "Formulation of liquid detergents with Cycloryl ABSA."

Cycloryl ABSA is dodecyl benzene sulphonic acid, supplied virtually 100% pure. Suggested formulae and manufacturing instructions are given in the new bulletins, copies of which are available free.

• • •

POLYTHENE FILM. BCL polythene is a tough, transparent, flexible thermoplastic film with wide uses as a packaging material. It is supplied in (*a*) sheet, (*b*) film, (*c*) cut sheets, (*d*) tubular film, (*e*) gusseted tubular film and (*f*) transparent, black and white opaque and in various colours. A recent sample card from British Cellophane Ltd., Henrietta House, 9 Henrietta Place, London, W.1, gives valuable information alongside samples of material from 120 to 500 gauge.



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Work Study in Dye Houses*

Experience has shown that changes can be introduced with minimum disturbance, provided they are properly planned and applied through the established channels of negotiation with full recognition of the importance of the human factor

By G. C. BATTYE, B.A.†

A DISTINGUISHING feature of the present-day practice of Work Study is its recognition of the value of good human relations. In fact, the average Work Study officer probably spends up to 80% of his working time in dealing with the effect of his work on the working methods of both line management and operatives and only about 20% on the techniques of method improvement themselves.

Another aspect of the human relations problem is industrial negotiations. My personal experience in this field is that there is a greater feeling of confidence when the case to be discussed has been prepared by properly trained Work Study personnel. It has been said in this connection that Work Study can be regarded as "narrowing the area of conflict." I regard this as a most useful observation. We are not concerned with getting more work from the workers for less pay. We are concerned with getting more for everybody through greater over-all efficiency.

No mention has yet been made of piece rates. It is a widely held fallacy that Work Study is just another name for rate fixing. This is just not true. Many Work Study officers do no rate fixing at all. Opinions for and against financial incentives are as divided among Work Study officers as among other sections of the industrial community. Work Study practitioners do feel strongly on one point, however. If you must have financial incentive systems of payment at least let them be accurate and equitable. In my experience many such systems set up without the aid of Work Study are unfair to one side or the other.

Work Study Approach

All Work Study investigations have the same basic pattern. When introducing Work Study into an organisation for the first time the first stage is to undertake a survey of the whole organisation. When this has been done the order of priorities for individual investigations can then be determined by discussion with the management on a rational basis.

When Work Study is subsequently started in one particular department the first stage is that concerned with the way the work is being carried out. This is called the method study stage and its purpose is to find the best possible way of carrying out the work within an agreed context. Method study is carried out on all levels and an important feature is its systematic approach involving five definite steps:—

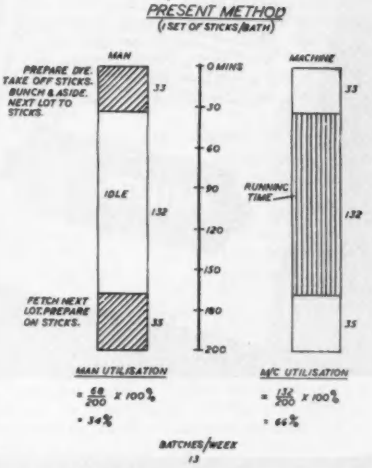
(1) Record details of present method.
(2) Examine and criticise the present method.
(3) Develop improved methods.
(4) Install the new methods.
(5) Maintain the improved methods in operation.

Consideration of methods from this disciplined approach results in not only our getting the best way of doing the job, but also in getting the best way in one step. This is a very important point. We all know the havoc which can be created by methods which are gradually allowed to be changed through improvements brought in both by operatives and management. Every change of method will involve different output potential, and in cases where the operatives are paid on piece work a different piece rate appropriate to each method should be employed. By getting the best way in one step and then carefully specifying the method to be used against the standard of output expected for a given level of performance, Work Study can remove one of the most potent causes of industrial discontent.

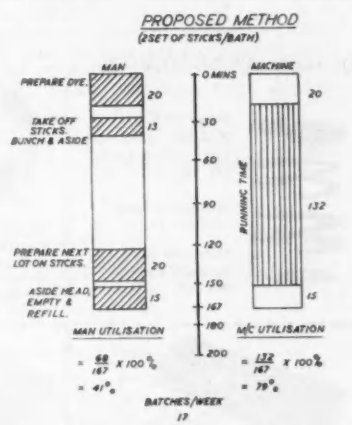
The next main stage of our investigation, when we have determined the best way of doing a job, is to say how long the job should take to do by an operative working at an agreed level of performance. This is usually done through the technique of stop watch time study and is called work measurement. Work measurement can be carried out over the complete range of industrial operations and the end product is a Standard Time Value which can be used in a number of ways. The standard time value for any unit of output represents the time taken by a properly trained, qualified and motivated operative to carry out the specified unit of work. We can use these time values to set piece rates, in production planning and control, or as a labour cost element in our costing figures. They can be further used in the case of those operatives working with machinery in finding answers to the somewhat complex questions of how many machines an operative can mind, and, under given conditions, what will be the resultant machine efficiency?

Work Study in Dye Houses

In dye houses we do not usually give first place to achieving the highest possible standards of operative performance. There are various reasons for this. The type of work, type of labour available to carry out the work, and most importantly the variation in the volume and type of work passing through the typical dye house. Variations of type and volume of work are subsequently reflected in the total physical work content laid on the operatives at any one particular time. Obviously, a dye house must be staffed up so that it can cope with conditions approaching the



Dye house man/machine activity chart



Dye house man/machine activity chart. 31% increase in production

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* *From a paper given recently to the Huddersfield branch of the Guild of Technical Dyers.*

† *Senior consultant, Wool (and Allied) Textile Employers' Council, Work Study Centre, Bradford.*

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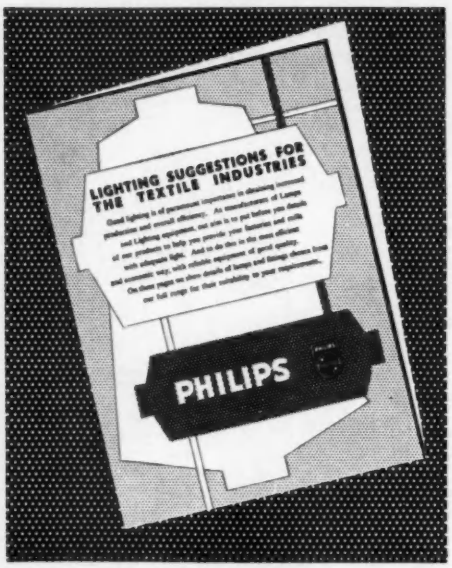

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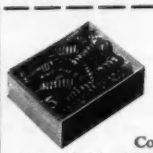

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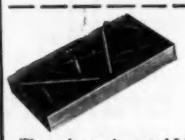

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heaviest work load likely to be encountered; if this is not done the production programme will fall behind. On the other hand, it has the disadvantage that for a considerable percentage of the working week the utilisation of labour is likely to be inefficient. I think we have to accept this state of affairs as a problem peculiar to the dyeing industry, and particularly perhaps the commission dyers.

In dye houses the major savings resulting from the application of Work Study are likely to be in the other elements of factory cost, i.e. overheads and materials. Reduction of overhead costs can be achieved mainly through greater production. Reduction of material costs can result from technical developments, outside the scope of Work Study, but also from greater control of material usage, and this is very much a Work Study concern.

Increasing Production

Consider the reduction of overheads through increased production assuming, of course, that extra work is available to take up the increased production capacity made available. The chart reproduced on the first page illustrates a simple example of what can be achieved by reducing the stopped time of a dye bath caused through work being done by the operative when the machine has finished its running cycle. In this case no spare sticks were provided on which hanks of yarn could be loaded by the operative while the machine was running. Providing a spare set of sticks enabled a 31% increase in production to be achieved. By providing spare sticks for all the machines in the department concerned (which employed 10 operators) a potential saving of about £10,000 per annum on reduced overhead and labour costs was achieved. In pressure dye houses, where capital cost of the equipment is much greater, this sort of improvement has greater significance.

In dyeing machines with removable heads, spare heads can be provided in the same way that spare sticks were provided in the example given above. Attention to the design of lifting tackle and ease of handling of such tackle when heavy loads have to be lifted out, can also produce considerable savings of time. Water can be pre-heated to cut down the time coming to the boil in the dyeing machine itself. Shows can be taken from prepared sample bunches rather than lifting out the work to take a sample from it. Testing staff can be made available all the time possibly with dyers checking each other's work rather than keeping to a too rigid system of individual responsibility for specified machines. The use of staggered working hours and working through break periods can also be introduced in properly controlled conditions.

On the subject of over-all organisation of a dye house I feel that many would benefit from the employment of an over-all manager, who should be a technical dyer trained in the administrative aspects of production management. The use of such a person would give much better co-ordination and distribution of the work and improve machine utilisation. In general terms if we consider the dyeing time to be more or less fixed, the way to increase the utilisation of dyeing machines is to reduce to a minimum the time they are stopped for discharging and refilling. The time required to perform the essential work which can only be done when the machines are stopped, we call the "outside work." It can be expressed in terms of standard time values determined by work measurement.

How can Work Study help in reducing the outside work to a minimum? The method study improvements referred to above are directed to this end, but the speed with which the operatives carry out their work is obviously another factor. As stated earlier, Work Study has a part to play in designing equitable financial incentive systems and of the deployment of labour. In dye houses careful thought must be given to both these points in order to encourage maximum output. Where two or more operatives can carry out the outside work together this is all to the good. Except in certain rather special cases, therefore, I consider that group working should be an essential feature of the labour deployment system in dye houses. Group incentive schemes can be devised quite simply in order to encourage and reward efficient group working. The prime information required is a list of the over-all cycle times for the various lots produced. These are obtained by adding the outside work times to the machine running times. When arriving at these standard time values, certain difficulties have to be overcome. For example, the number of additions required may not be easy to forecast. The important point is to establish reasonable working standards and then arrange to show up excesses against the standards. In this connection we must remember that the fact that job costs have been arrived at, means that certain assumptions have already been made about such variables as the number of shows or additions. It can be an enlightening process simply to establish and put down on paper what these assumptions are.

Conservation of Material

The second main aspect of our work in dye houses is in connection with the utilisation of materials. Formulation of standard recipes is clearly the technical dyer's responsibility, but responsibility for the incidence of excess material costs is often less clearly defined. Particular types of work may be difficult to dye, and may be causing excess costs whenever they are processed. These excesses may be in labour, machines or materials, or all three. Unless there is a definite system for showing up these excesses, it is likely that the unprofitable lines may not be known to management. Excess costs should be reflected in the selling price, or where policy dictates that unprofitable lines are put through at normal costs, it is important to know just what is involved.

In the case of standard recipes, it is appreciated that agreement about what standards should be, may be difficult to achieve. This is no argument for not doing it, however, and co-operation at this stage by the technical dyer is of the first importance. In the long run moreover it should be to his positive advantage. It should relieve him of a great deal of worry about work which is going wrong. By providing management with much more specific information about re-dyes, excess additions, excess machine and labour costs it will enable consideration to be given to the possible discontinuance of such work.

Control Information

Standards are used to control excess costs through the use of the principle of control by exception. This means that we only report on and control work which is going wrong and not that which is proceeding normally. The savings in paper work from this type of approach are obvious.

In practice, simple control reports and indices are prepared jointly by the cost and work study offices. Excesses are shown up under the headings of material, labour or machine time. These statistics are analysed to determine trends, and thus lines causing trouble can be identified and a positive excess cost figure arrived at. It should be emphasised that such a system is easy to run and really serves to pin-point the vital factors involved in running a dye house profitably.

Examples of the type of control index which might be used are given below, but different types of dyeworks will need different indices to meet their special problems.

$$\text{Overall Machine Utilisation} \;..\; \frac{\text{Lots produced} \times \text{Standard Cycle Mins. per Lot}}{\text{No. of machines installed} \times \text{available mins. per machine}} \times 100$$

$$\text{Overall Labour Utilisation} \;..\; \frac{\text{Total Labour Cost}}{\text{Total Cost of Sales}} \times 100$$

Dyeing Nylon Piece

The Irga-Solvent process for nylon is a new method developed by Geigy (patent pending) for applying acid dyes to nylon piece on the jig to obtain shades said to be faster to washing than those obtained with disperse dyes. It involves the use of benzyl alcohol as a dyeing assistant, together with an anionic product, Irgasol NJ. The process is claimed to offer the following special advantages:—

(1) Production of a wide range of shades of all depths on nylon faster to washing than those obtained by normal disperse dyeing methods.
(2) A high degree of dyebath exhaustion, giving (*a*) excellent reproducibility from laboratory matching to bulk and from batch to batch, and (*b*) a level of production never before achieved on nylon fabric.

Geigy have issued a list of colours suitable for application by the process, and with these a very wide range of shades can be obtained.

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Chemstrand Report Record Sales

Chemstrand Corporation announce record sales for 1959. Consolidated sales for "Acrilan" and Chemstrand nylon during the year totalled $197,320,824 compared with $172,968,381 in 1958. These figures include results of Chemstrand Ltd. and overseas sales of Chemstrand U.S.

• • •

New Appointment

In view of the extension of the company's technical service department by the opening of new laboratories, Ciba Clayton Ltd. have appointed Dr. J. K. Skelly, F.S.D.C., A.R.I.C., to be an additional deputy chief colourist.

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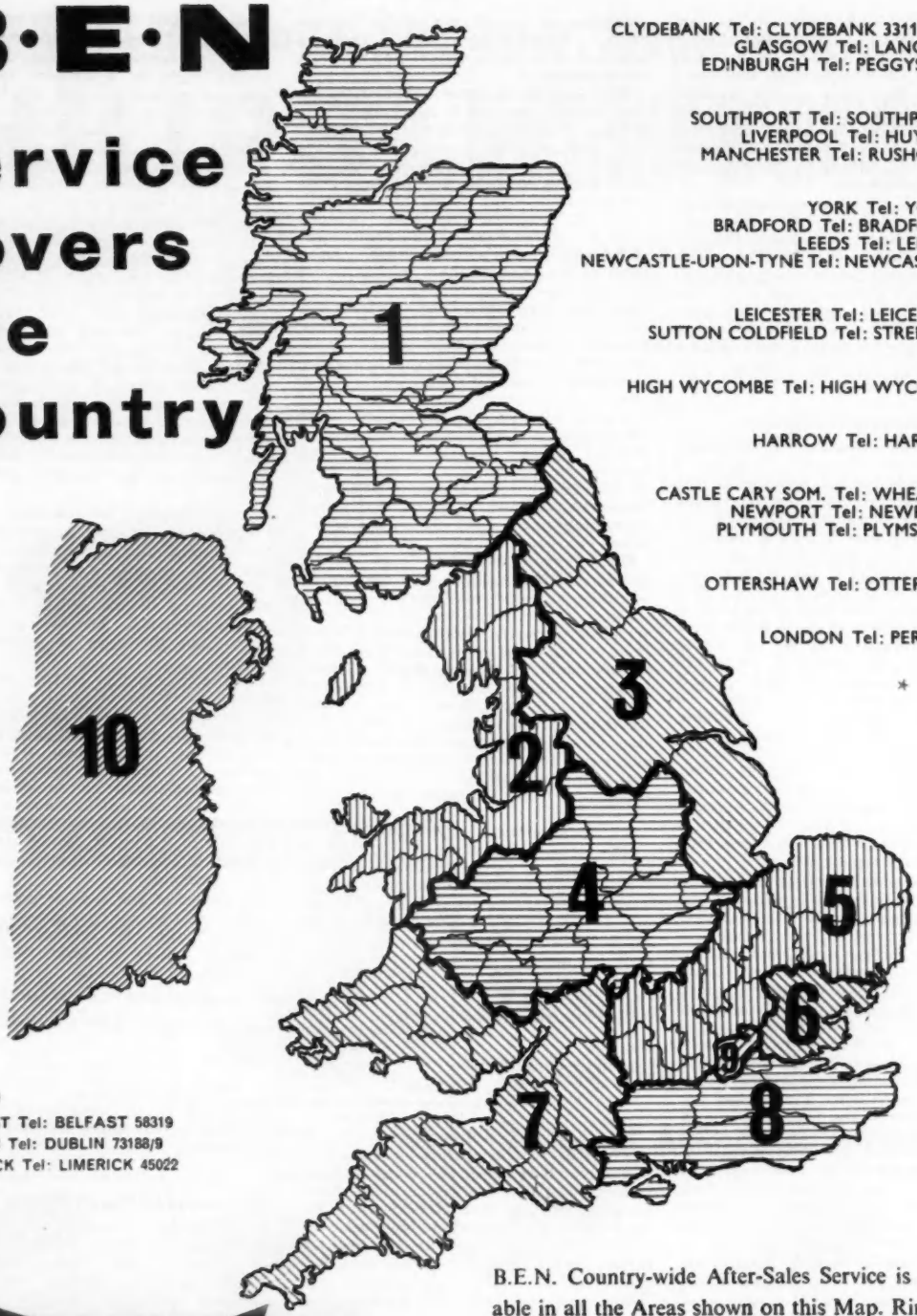

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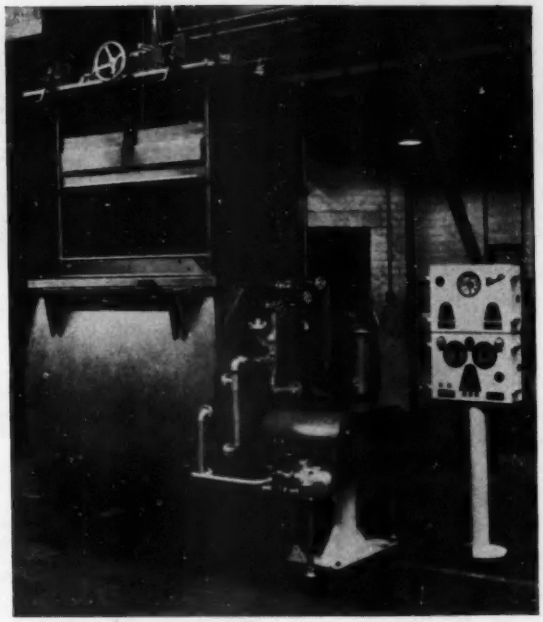
Dyeing Hanks, etc., by Modern Techniques

Where required, this latest machine can be converted to dye material in cheese form, loose form, and worsted tops in cans, etc.



Overall view of "Plusflo" hank dyeing machine. Innovations enable loose materials, cheeses or worsted tops to be dyed, in addition to hanks

INTRODUCED at the last textile exhibition at Belle Vue just over a year ago, the "Plusflo" hank dyeing machine made by Freeman, Taylor Machines Ltd., Syston, Leicester, has recently had some important modifications incorporated. Designed in the first place for dyeing hanks it can now, if required, be converted for dyeing materials in loose form, cheese or worsted tops. The following advantages are claimed for this latest model:—

(1) Perfect levelness using premetallised and fast neutral dyes, experience showing on botany wools a uniform staining even after 10 mins. immersion.
(2) Material leaves the machine full, free and in perfect condition for winding.
(3) Handles three and in some case four batches a day. Ease of loading in the open frame permits hanks to be pegged up and quickly unloaded.
(4) Comparatively high capacity rating for small physical size tank, resulting in an economical liquor to goods ratio.
(5) Operation at a reduced liquor level, reduced volume when dyeing shorter hanks, and useful savings in steam and chemicals.

By positioning a separate hank cage box centrally within the machine so that a clear annular type space is formed between it and the walls of the tank it has been possible to obtain a four-sided weir having a total length of 15¼ ft. for the 200 - 300 lbs. machine which, it is claimed, ensures a uniform, low velocity, large volume flow. The flow is further balanced by being passed through grille plates of a special "V" slotted design situated at the top and bottom of this box. These two features provide a flow in excess of 4 galls./lb. of material per min.

The hanks are supported on upper and lower sets of poles, staggered in such a way that the maximum quantity of material can be accommodated and the flow does not impinge directly on the hank. A useful pole space of 55½ ft. for the 200 - 300 lbs. machine is contained within a cage of very compact overall dimensions.

The makers point out that a liquor to goods ratio of approximately 20 : 1 compares most favourably with conventional machines and offers real economies in steam consumption for heating, particularly when taken in conjunction with the reduced liquor level brought about by the use of the adjustable weir.

Under normal conditions this machine will accommodate hanks varying from 47 to 72 ins. reel length. The top poles are supported in an assembly which is, in effect, an upper extension of the hank cage box, the top lip of this extension forming the four-sided weir.

For short length hanks the upper pole assembly can be lowered to obtain the correct pole centre distance and in so doing the four-sided weir is also lowered enabling the level of liquor to be reduced. For all normal lengths of hanks the liquor to goods ratio is approximately constant. A further advantage of this upper pole assembly is that means for automatic adjustment can be readily added to accommodate progressive yarn shrinkage during processing. To provide for the dyeing of special short hanks the bottom pole frame can be raised.

An efficient closed coil heat exchanger situated in the annular type passage between the hank cage box and tank walls and gives uniform and rapid heating. Means are also provided for passing cold water through the heat exchanger for cooling the dye liquor on completion of the cycle or for addition of dyestuffs during processing, if they require to be introduced at a reduced temperature. With this system there is no contamination of the liquor by condensate and the pH value remains unchanged.

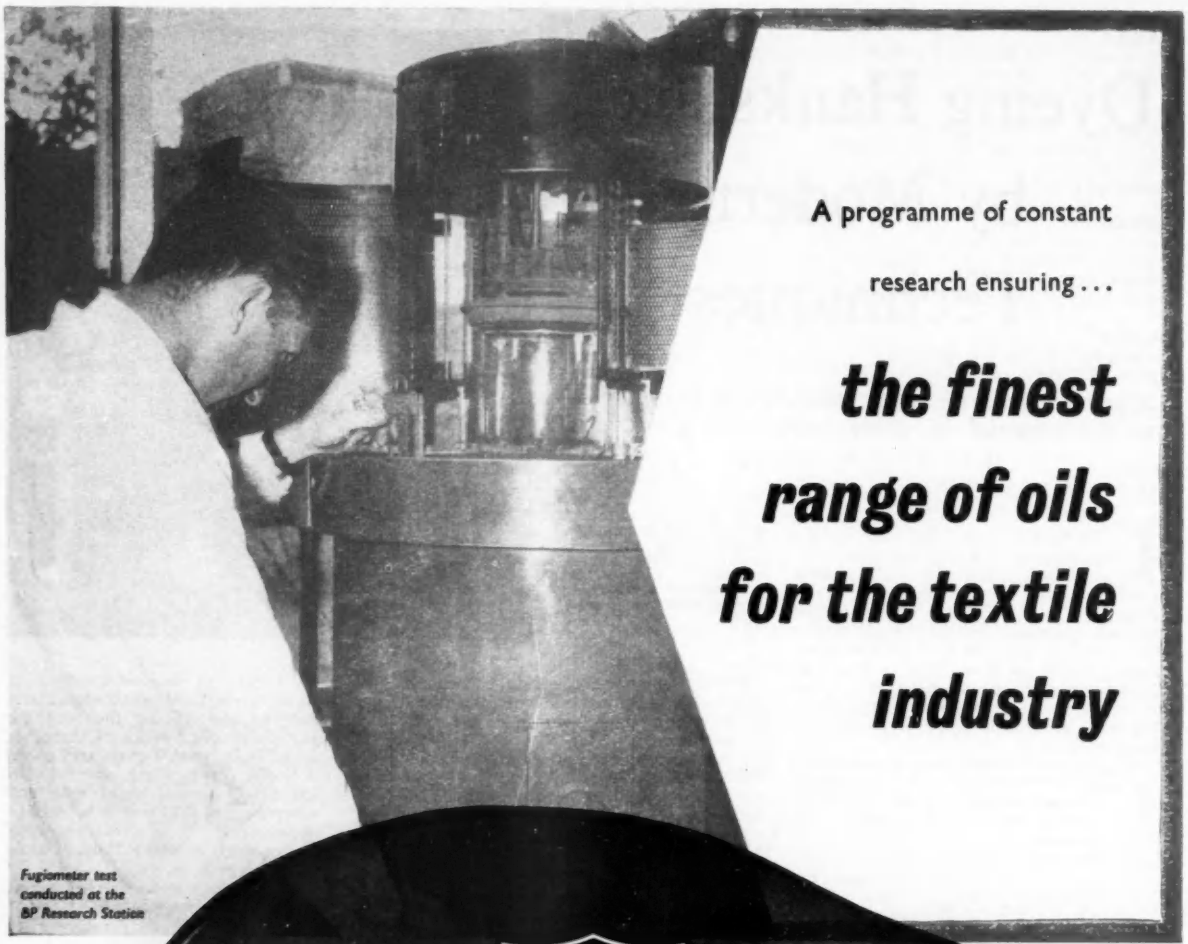
The liquor is circulated by right- and left-handed propellers in the bottom of the tank. Two alternative forms of drive to the propeller shaft are available for the 200 - 300 lbs. machine.

(1) By means of a reversible electric motor through an infinitely variable speed pulley. This motor can be manually controlled or an automatic controller of standard F.T.M. "Autorev" design can be supplied as an extra.
(2) By means of a four-speed drive using two squirrel cage motors intercoupled and driving the propeller shaft through V-velts. Control of speed is by push-button and speed pre-selector by which any forward speed will be combined with any reverse speed. This will be carried out automatically if a reversing controller, such as the F.T.M. "Autorev," is installed.

To enable dyeings to be carried out at temperatures in excess of 212° F. (100° C.) the machine can be lightly pressurised to 2 lbs./sq. in. (218° F./103° C.).

The tank and internal components are constructed from heavy gauge molybdenum bearing stainless steel. All components are carefully designed to prevent pockets and traps which might carry over liquor into the following dye. The tank utilises the F.T.M. "Curvilinear" construction. The upper pole assembly is mounted, and free to slide, on a tubular frame which also carries the bottom pole assembly, the whole being supported from the lid structure. This assembly has been designed to avoid any projections which might foul or snag the yarn. The poles used in this machine are of F.T.M. patented design. Being of tubular form they are strong, light in weight and easy to handle. The tapered ends of these poles are spring-loaded outwards to form a tight seal in the cage walls.

The lid of the machine is also of "Curvilinear" form and incorporates along its edge a special sealing device against the top of the tank. The lid is retained by a number of claws actuated by a common shaft. A dye feed bowl is situated at the end of the tank. This bowl contains a fine mesh filter and boiling coil and is used for boiling up the dye concentrate and then injecting it into the propeller ducts by steam pressure where complete dispersion is assured before entering into the goods. A feed sight glass indicator is fitted to show the flow of the dye concentrate into the tank. A sampling device in the lid of the



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machine can be used without the necessity for reducing the internal pressure in the machine.

Recent Trials

A bulletin issued by Freeman, Taylor Machines Ltd. gives details of some trials conducted with the co-operation of N. Corah (St. Margaret) Ltd., Leicester, in whose dyehouse the 200 - 300 lbs. machine had been installed. The results of these trials are reported to have been extremely good and the information gained is summarised herewith. The following figures taken at random illustrate typical loadings of this machine:—

Wool Yarns

Botany Hosiery Yarns—
250 lbs: 72-in. reel; premetallised dyestuffs.
Crossbred Yarns—
300 lbs.: 72-in. reel; level dyeing acid colours.

With botany yarns, a satisfactory dyeing was obtained with a 100-lb. load of full length 72-in. reel length hank.

Acrylic Yarns

"*Courtelle*"—
80 lbs.: fingering counts; basic dyestuffs.
"*Orlon*"—
75 lbs.: 2/45s count; dispersed acetate dyestuff.

Both the "Courtelle" and "Orlon" yarns were high bulk type, and previously steam relaxed.

Condition of Dyed Yarn

All hanks were found to maintain their position throughout the dyeing under all conditions of loading. In every case, the yarn proved absolutely free, with no trace of milling, and no broken ends. Absolute levelness of dyeing has been proved conclusively, it is stated, by repeated tests in which hanks from the ends, sides, and centre of successive batches have been separately wound and knitted into garment lengths, where any unlevelness may become immediately apparent. The results of these initial trials were considered extremely good.

One of the interesting points arising from these trials is that the "Plusflo" has also proved very efficient for scouring wool yarns. This process is carried out at 120°F. in approximately 30 mins., using soap and/or synthetic detergents, according to the practice of the individual dyer. During trials, the prototype "Plusflo" has been operated at liquor temperatures up to 218°F. as well as under normal atmospheric conditions. The advantages of achieving a "true boil," or temperatures in excess of this, together with other advantages which the machine confers, point to reduced process times and, in the opinion of certain Companies who have used this machine, to the probability of four "runs" per shift.

A second bulletin outlines additional trials successfully carried out on further yarns, including:—

(1) Premetallised dyes on 300 lbs. of 72-in. reel carpet yarns.
(2) Basic dyes on 60 lbs. of "Acrilan" hand knitting yarn 4/10's count, 54-in. reel. The trial indicated that 80 to 100 lbs. of this material could be successfully dyed.
(3) Basic dyes on 75 lbs. of 2/28's "Courtelle." Two such dyeings were carried out within 8 hours including the unpacking and preparation of the yarn. Here again, the machine was considered under loaded.
(4) Fast neutral dyes on 200 lbs. of 2/28's botany yarn, 54-in. reel.

A trial dyeing of 280 lbs. of woven cotton fastener tapes proved the machine's ability to handle this material with slight modification to the lower hank frame unit to accommodate these 108-in. reel hanks.

Book Review

FRICTION IN TEXTILES. H. G. Howell, K. W. Mieszkis and D. Tabor. Butterworths' Scientific Publications, 4 and 5 Bell Yard, London, W.C.2 (price 43s. 6d. post free). In the U.S.A.—Textile Book Publishers Inc., New York.

Without it, life in any shape or form would be impossible, but neglected or uncontrolled, friction is probably the greatest nuisance afflicting industry in general. In the various sections of the textile industry friction undoubtedly causes more headaches and processing complaints than any other single factor including variability in materials, machines and methods. The theoretical and actual forces at work have been the subject of a tremendous amount of technical and scientific work, a substantial proportion of it being carried through without an overall plan in view. Similarly, the literature—up to the appearance of this valuable work—has been extensive but very scattered, a point of considerable irritation to researchers and others seeking reliable information and guidance. Within the compass of 250 pages, the authors have achieved outstanding success in setting out in a perfectly logical manner a concise but critical account of fibre friction and its established effects on textile processing.

The book has been divided into three parts, the first section dealing with the theory in friction and lubrication. Here under the headings of (*a*) general mechanism of friction, (*b*) friction of plastics and of fibres and (*c*) mechanism of lubrication, the aim has been to emphasise the main picture as it exists today, also the many difficulties and inadequacies that have still to be resolved. The second part divided into: (*a*) friction of wool, (*b*) friction in spinning, (*c*) friction in winding, (*d*) friction during conversion of yarns into fabrics, (*e*) interfibre friction on strength of tyre cord and (*f*) friction in fabrics, covers the practical problems in textile processing. The third section covers (*a*) measurement of friction of yarns and fibres, (*b*) control and measuring of tension and (*c*) measurement of abrasion. Finally, an appendix gives some typical values of the co-efficient of friction under various conditions of test and includes an extensive bibliography where further experimental data can be found.

This classical piece of work could hardly have been better timed and the publishers and the Textile Institute must be congratulated on this excellent testimonial to their co-operation. The subject itself will become increasingly important as new developments in fibres, machines and surfaces, etc., arise together with the trend for higher speeds and more automation. Equipped throughout with adequate references, a name index and a subject index, this well printed and beautifully bound volume immediately commends itself. There is nothing to criticise and we have no hesitation in praising a book of inestimable value to all concerned with textile processing. Every mill, research laboratory, technical college and library should have this comprehensive classic always available.

A.L.F.

* * *

Wool Disposals

The Board of Trade announce that during the year beginning April 1, 1960, sales of wool from the stockpile will be continued at the London Auctions at about the same rate as in the preceding year. Sales will as usual be carried out on the Board's behalf by the British Wool Federation.

High Tenacity Rayons

(*continued from page 64*)

applied, the resultant change in length is not so great. In practice, this may not be the pattern, i.e. the nylon cord may have the opportunity to contract before it comes under load (e.g. in the moulding process), so that it is possibly advisable to measure the change in length of the cord, after it has contracted. Some results, based on this type of measurement are given in Fig. 6. In one case, the cords have been dried at 20°C. in dry air before applying the load; in the other, they have been heated to 105°C. before applying the load.

It may be seen that the creep tendencies of the rayon cord are much lower, thus indicating improved dimensional stability when in a tyre.

The improvement of rayon tyre yarns is a continuing process. It must be remembered that these yarns are tailored for a particular end-use, so that they are given the characteristics required to perform that duty with the greatest efficiency possible. Current work suggests that it will be possible to produce in the near future, a yarn with an oven dry tenacity of 6·5 to 7·0 grams/den. With even more radical changes in the method of spinning these yarns, coupled with improvements in the technology of converting them to cord and changes in the surface characteristics of the filaments, it should not be difficult to keep pace with the ever-increasing demands made upon them by the motoring public.

References

(1) Recent Advances in High Tenacity Rayons. Courtaulds Ltd. publication.
(2) Du Pont Tyre Yarn Review. May, 1959.
(3) Lyons and Prettyman; T.R.J.; 23 (1953), 917
(4) Parker and Kemic; Symposium on Rayon Tyre Yarn Progress; January 23rd, 1958.

Acknowledgment

Acknowledgment is made to the Directors of Courtaulds Ltd for permission to publish this information

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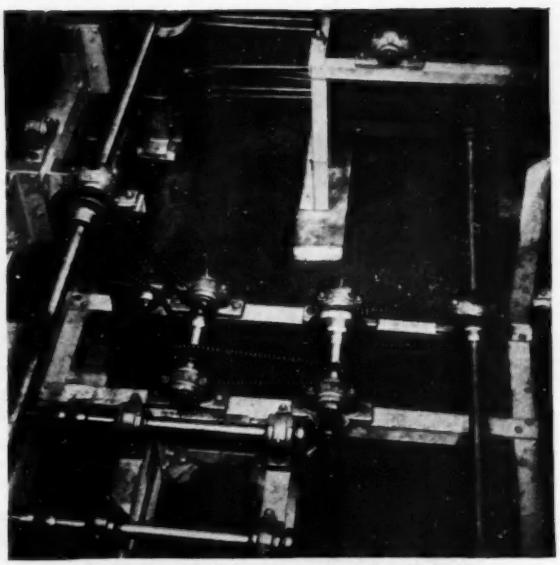

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Textile Trade and Prospects

Linen Trade Review

The spectre of raw material shortage, which has curbed the industry's forward movement from the 1958-9 recession, seems destined to haunt it in the forseeable future. With the few transactions in Soviet flax now being made specifying delivery dates in the last quarter of the year, and the downward trend of fibre deliveries in west European markets while most spinning mills are stocked far below their normal seasonal cover, with considerable difficulty being experienced in meeting both quantity and quality requirements, spinners are naturally reluctant to accept yarn commitments beyond their immediate cover.

Such efforts as are being made to solve the problem lack the coherance, originality of approach and the positive action that its importance merits. The whole question needs to be considered in the experience of former abortive efforts to solve it to avoid a repetition of the mistakes and failures of the past, and with emphasis on creating a demand from the spinning end—which will automatically stimulate production—rather than placing it on production in the first instance in the hope that a demand may arise.

The spinning section can contribute much to a solution of the problem by co-operation in solving specific processing problems. In so far as domestic production is concerned a satisfactory solution is of greater consequence to the spinner than to the grower. The latter has choice of a number of crops, any of which may be no less profitable, and all certainly less speculative. Declining external resources make the spinner increasingly dependent on domestic supply, the alternative being to change over to man-made fibre staples, or to cease production.

Latest statistics show that, while the intake of man-made fibres by the cotton and wool industries continues to increase that to the linen trade has made little progress in recent years. This is all the more surprising in view of the fact that flax type processing machinery is being installed in other sections of the industry to cope with the expanding demand for certain classes of man-made fibre yarns. There is undoubtedly considerable scope—and available productive capacity—for developing production in the linen industry with little further capital outlay. Man-made fibre products have made considerable inroads in recent years in linen's main sphere as a household textile. If linen is unable to meet them in open competition on a price basis the alternative is to adopt them as an ally, as it did with considerable success in the war and immediate post-war years.

At the 40th annual general meeting of the Linen Industry Research Association the chairman, Sir William Scott, said investigations were being carried out on blends of flax with man-made fibre staples. Good progress had been achieved in evolving blend fabrics with distinctive characteristics likely to commend them in world markets. To make research fully effective a two-way traffic of ideas and developments between scientists and those engaged in the industry will require to be developed. The conservative outlook and rugged individualism which have long been characteristic of those engaged in the industry have not favoured co-operative effort.

Wool Production and Prospects

Because of higher wool clips in Australia and the Argentine, the Commonwealth Economic Committee's estimate of free world wool production for the current 1959-60 wool year has been amended to 4,475 million lbs. (greasy basis), or 3% more than in 1958-59. With higher Soviet output, total world production of wool is estimated at about 5,545 million lbs. (or 3,165 million lbs. clean), representing a rise of 4% on the amended 1958-59 total of 5,345 million lbs.

Britain set up a post-war record in exports of wool tops during 1959, with shipments of 96 million lbs. (7 million lbs. more than the previous 1958 record of 88·8 million lbs.). Exports of merino tops last year totalled 49·4 million lbs., an increase of 2 million lbs. on the previous year. Crossbred top shipments were substantially unchanged at 35·9 million lbs. Canada, China and India, were the three largest overseas customers for British-combed tops, though shipments to China were only two-thirds the volume of the previous year.

Board of Trade figures, detailing these latest wool records, also show that U.K. wool yarn exports last year were nearly 20% greater than in 1958, while woollen and worsted cloth exports showed an improvement of 7%. In achieving this larger export trade, and in catering for the expanded needs of her home market for wool goods, the U.K. last year imported 752 million lbs. (actual weight) of raw wool, compared with 658 million lbs. the previous year, an increase of 14%. Of last year's total, no less than 80% was imported from Commonwealth sources of supply. Australia provided 334 million lbs., New Zealand 171 million lbs., and South Africa 65 million lbs. Compared with the previous year, the increase in wool imports from Australia was 42 million lbs. New Zealand wool 3 million lbs., and South African wool 12½ million lbs.

More wool was used in the U.K. wool textile industry during 1959 (517·8 million lbs., clean weight) than in any year since the 1950 boom year, when it touched 528 million lbs. Last year's total was an increase of nearly 15% on the previous year. Weight of wool and hair tops produced in the U.K. last year set up a new record at 348·3 million lbs., or 17% more than in 1958. Worsted yarn deliveries of 232 million lbs. were 12½% more than a year earlier and within 2 million lbs. of the previous best. Wool cloth deliveries last year totalled 365 million sq. yds., nearly 5% more than in 1958.

Imports of wool cloths into the U.S.A. between January 1 and January 16 this year totalled 4,314,583 lbs. This is 165% greater than in the corresponding period last year. Under the tariff quota, fabrics up to a specified total weight may be imported into the U.S.A. at an *ad valorem* duty of 25%. When that total weight has been received, the duty on similar goods for the remainder of the year is increased to 45%. The quota for this year has not yet been announced but imports for the first fortnight of this year were approximately equivalent to one quarter of the total normal duty quota for last year. They indicate that substantial quantities of fabric from all main supplying countries had been waiting in bond for the reopening of the quota on January 1. The American Tariff Commission is reviewing the whole operation of the quota.

Jute Fibre, Yarns and Fabrics

So far this year, demand for jute goods in Dundee has remained steady with machinery running to full capacity. Orders continue to be placed and supplies of certain descriptions are only available in the forward position. Backings for linoleum and carpets are now one of the main outlets for the jute industry, and demand for this type of material has been good of late and there is every prospect of orders continuing in the future. The heavy end of the trade has also found a steady demand for its products. Narrow sackings in particular have been in request and some substantial orders have been placed. The outlook for cloth at present is bright with most manufacturers sold two to three months ahead and orders are still being placed. Consumers are now taking less interest in any possible price change but are having to place orders to obtain the required delivery. Spinners are busy and there are signs that this improvement in the position will continue for some time to come. Very often demand begins to slacken off at this time of year but so far there are no signs of this being the case on this occasion.

The raw jute markets have been very quiet during the past month and prices of all grades have declined. The position in Pakistan is rather obscure and it is difficult to assess future trends.

Imports of loose jute from up-country in Pakistan are very small but at the same time fair stocks of the fibre are being held by shippers there. The future price trends of raw jute depends to a large extent on whether India will have to purchase substantial quantities of the fibre from Pakistan before her own new crop material is available.

Demand for raw jute from the U.K. has been very small during the past month. Dundee spinners are holding large stocks of raw material and they are in no hurry to increase their holdings especially when prices are declining. At the same time a

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substantial quantity of spot and afloat jute is being offered to the U.K. at present at prices well below current shipment rates.

Mill Firsts are available at £114 10s., Mill Lightnings at £101, Mill Hearts at £90 and grade Hearts at £80, c.i.f. U.K., for Feb./Mar. shipment. Grade Tossa-2/3 is available at £112 and grade Tossa-4 at £99 with Continental Tossa-2/3 at £92. Crack Daisee-2/3 is at £100 and grade Daisee-2/3 at £91, Feb./Mar. In some instances afloat parcels are available at up to £5 per ton below the above rates and Mill Lightnings were sold at £95. A few offers of new crop came on the market towards the end of January with Mill Lightnings at £95 and Mill Hearts at £85, c.i.f. U.K., for Aug./Oct. shipment. This did not attract spinners to any extent possibly because of the very low prices being asked for afloat old crop material.

Although Dundee spinners had a large carryover from the previous season and have already purchased a quantity of excess of their consumption from the present crop they still have a substantial amount of fibre to secure from the present crop. It is possible that a further 200,000 bales will have to be obtained this season. Continental spinners will also have to purchase a substantial quantity and this could maintain prices at or around the present levels.

The Calcutta goods market has fluctuated within narrow levels of late. The Indian Government has placed some substantial orders with the mills for sackings but this did not influence the market to any extent.

Buyers in the U.K. have been purchasing but the quantities were not large. Quotations are at 62s. 6d. for 10 oz. 40 in., and at 46s. 6d. for 7½ oz. with 11 oz. 45 in. at 68s. 9d. per 100 yds. f.o.b. Calcutta for March shipment. B twills were at 170s. 3d. March. Indian mills are busy at present and there is every indication of this continuing in the immediate future. Stocks of goods held by the mills are now at a very satisfactory level with sackings at the lowest for a very long time.

The Scottish flax industry is busy and most spinners have orders in hand for delivery well forward. Prices of yarns are very firm and the trend is for them to become dearer. Consumers are not following this dearer position at present and actual new business now being placed is small. However, spinners remain busy with previous orders. The raw material markets are steady but there is only a small movement taking place at present.

Cotton Yarn and cloth Markets

No great changes have occurred in cotton yarn and cloth markets. Although business in every direction is much better the spirit is somewhat damped by the steadily increasing scrapping of spinning, winding, etc., and weaving machinery declared redundant following the Government proposals. Events of this nature can never be separated from the undesirable aspects associated with it. Some excellent machinery is being sacrificed along with the worn-out types and a mill closing down is like some dying mammoth—attacked from all sides by those parasitical elements that never lose an opportunity to snatch something from the chaotic circumstances. Expensive accessories and vast quantities of spares have been "sold" at fantastically low figures, in fact, any price to get them out of the way before awkward questions are asked.

In the meantime, business activity is undoubtedly better than for several years in those concerns which have decided to continue. Production amongst the remaining spindles seems higher, and in addition to other reasons there may be a psychological aspect about this. Inquiry for yarns has covered every type of count and quality. As usual most of the turnover has been on home trade account, although slightly more interest has been shown in one or two Continental outlets. Standard weaving qualities on ring beam, cop, cone and cheese have been well supported and coarse ring twists have sold well. Hosiery yarns in single and folded qualities have been ordered in greater volume. Blended yarns are in keen request and fine combed doubling wefts have been accorded more favour. Novelty yarns and specialities, and condenser types are in good demand. In most cases spinners order books tend to lengthen — a paradoxical situation — as buyers exhibit more interest. It has been an anxious time for some manufacturers trying desperately to find the right sources for their particular yarns when their suppliers for many years have closed down.

The volume of inquiry for cloth remains encouraging and in a few instances the yardages booked have been far greater than for a long time. A large part of the buying activity has centred around dress cloths in the medium price/quality range. Some very attractive lines in woven novelties in dobby and jacquard structures have been sold. Fresh, colourful screen and roller printed fabrics have commanded attention for spring and summer trade. Blended cloths of cotton/viscose, cotton/nylon, etc. are in good request. It is a similar story with furnishing cloths. Bright contemporary designs in jacquard weaves continue to find favour and traditional styles never lose their appeal. The total turnover is much better and should continue well into the future. The whole lackadaisical policy of cloth buying has received tremendous impetus from the loom scrapping programme. Household textiles are selling very well indeed. Medium and higher quality towellings, sheetings and quilts are in good demand, but the cheap qualities are moving rather sluggishly.

Silk and Man-Made Fibres

Activity in the silk and man-made fibre sections of the industry continues on a good tone. Order books, in general, are in a healthy state with delivery times in certain cases longer than they should be in a competitive industry. Silk is in great demand and there is a steady call for secondary acetate and viscose in filament and staple. There is no hold-up in yarn production and most qualities are available on request. Bulked yarns retain their popularity for certain fabrics and woven dress goods in dobby, jacquard and screen, etc. printed designs are in keen request. Furnishing fabrics have been in good demand for the home market and there has been more than passing interest in South Africa for British-made furnishings. One or two Continental outlets have also taken higher quantities of rayon and cotton printed furnishing cloths; some pleasing novelty effects have been sold in attractive constructions. In shirtings, blends of "Terylene" and cotton are selling well, and there is considerable interest for rayons for sports' shirtings. A new finish on dress fabrics has aroused much interest. Briefly, this is a finish obtained by the application of a resist which blocks sites on the fabric, but does not affect the embossed portions, which take a dye in the ordinary way. The pattern of the emboss, therefore, is revealed. Acid dyes are used for nylon fabrics and disperse dyes for" Terylene."

Yorkshire areas are active with most types of worsted and woollen fabrics in good request. Blends of "Terylene" and wool are steadily increasing in style and range, also wool and "Acrilan." Knitting interests in Yorkshire are busy on ladies' and men's knitted outerwear chiefly in blends of wool and nylon, but there is a fair amount of wool and rayon, and all-nylon. Leek and Macclesfield areas report one of the most prosperous periods for some time. Smallwares are still affected by seasonal fluctuations at the moment, but most types of narrow fabrics are sought. Ribbons, gimps, petershams and so on, are in demand and varied fancy effects are selling well. Business in laces, cords, and foundation garments continues good with nylon the most popular choice. Jacquard woven labels find ready buyers and there is a tendency for an increase in the number of colours being used.

Macclesfield printers are happier as a result of the influx of new business and order books are now filling up. Block printers, of course, continue to be employed on a steady basis. Weavers are also busier and commission dyers and finishers, although business is competitive, find plenty of work. Throwsters are probably as busy as at any period since the war. Pressure in the Leicester area has eased-off in full-fashioned stockings whereas at Hinckley order books are well filled with he demand for seamless hosiery. Manufacturers of nylon knitted warp-knit fabrics report good business.

Mohair Returns to South Africa

South African mohair, woven in Scottish mills into rugs, scarves and stoles, is going back to South Africa as part of a remarkable display of textiles at the Johannesburg Rand Easter Show to be held from April 4 to April 23. The whole of the British Pavilion, built this year as a permanent show place for British goods, has been put at the disposal of the textile industries. Six member firms of the National Association of Scottish Woollen Manufacturers will be represented. One of the chief factors affecting acceptance of these has been eye appeal. Another qualification is that the cloth should be suitable for South African use.

Glen Cree Ltd., Newton Stewart, are sending a rug of pure South African mohair in the Royal Stewart tartan while South African mohair rugs, scarves and stoles will also be on show from West of Scotland Home Industries, Girvan. From John Lawson and Sons Ltd., Kilmarnock, there will be blazer venetian cloth fast to tropical sunlight. A luxury sports cloth in fancy twists of silk/saxony and worsted/saxony, suitable for sports jackets, will be shown by William Brown Sons and Co. Ltd., Galashiels. W. F. Stewart and Co. Ltd., Galashiels, will have on view three Glen Stewart cloths and a lightweight shetland type cloth, of 12 ozs., in pure wool is contributed by A. and J. Macnab Ltd., Edinburgh.

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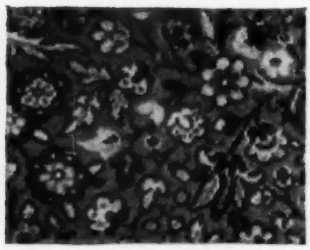

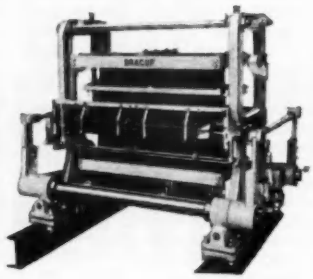

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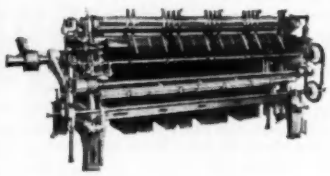

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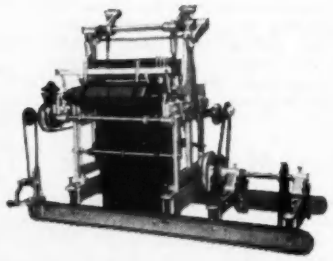

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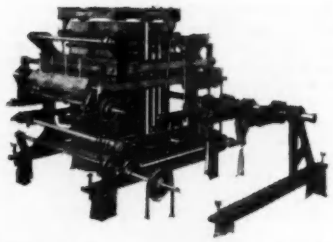

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Notes and News

Design in Textile Machinery

The Council of Industrial Design is organising a one-day conference on "Industrial Design and Textile Machinery' at the British Rayon Research Association, Heald Green, Manchester, on March 17, 1960. Chairman of the conference will be Sir Ernest Goodale, vice-president of the Federation of British Industries and chairman of the F.B.I. Industrial Art Committee. The aim of the conference is to study the role of industrial design in relation to this specialised field of the engineering industries, and it will be attended by senior management representatives from companies which manufacture or are concerned with textile machinery in all the stages and forms of textile processing. The conference will discuss the value of industrial design from the machinery user's point of view; the relation between industrial design and technological developments in industry; the role of the industrial designer in present-day engineering, particularly in the textile machinery industry; and the encouragement of an appreciation of industrial design among those already employed in textile engineering.

PROGRAMME

Chairman: Sir Ernest Goodale, C.B.E., M.C.

11.25 a.m. First Address
"Putting Industrial Design into Practice"
Speaker: Mr. W. L. Mather, O.B.E., M.C., T.D., M.A., Director, Mather & Platt Ltd.

11.50 a.m. Second Address
"The User's Approach to Textile Machinery Design"
Speaker: Mr. G. Waggett, M.Sc., A.T.I., General Manager, Arrow Mill, Courtaulds Ltd.

12.10 p.m. Discussion.

2.30 p.m. Third Address
"A Survey of Technological Trends in Relation to Textile Machinery Design"
Speaker: Mr. V. Duxbury, B.Sc. (Tech.), A.T.I., Lecturer, Manchester College of Science and Technology.

3.00 p.m. Fourth Address
"The Role of the Industrial Designer"
Speaker: Professor Misha Black, O.B.E., R.D.I., F.S.I.A., M.Inst.R.A., School of Industrial Design (Engineering), Royal College of Art; Senior Partner, Design Research Unit, London; Member of Council, C.o.I.D.

3.20 p.m. Discussion.

4.20 p.m. Fifth Address
"The Role of the Council of Industrial Design"
Speaker: Mr. Paul Reilly, M.A., Hon. F.S.I.A., Director, The Council of Industrial Design.

4.40 p.m. Chairman's summary.

Tough, Ductile Stainless Steel Filter Material

Sintered Products Ltd., Sutton-in-Ashfield, Notts., a member of Sheepbridge Engineering Group, are now producing Porosint Rigimesh—a new stainless steel filter material. Embodying the heat resisting and corrosion resisting characteristics of stainless steel, this tough, ductile and fracture-proof material is arousing considerable interest in many industries. This company also produce Porosint bronze filter materials, Durasint friction materials, and an extensive range of Durasint structural component parts.

* * *

New Scheme for Mill Workers

Another advance in industrial relations within the Yorkshire woollen industry has been announced by Joseph Newsome and Sons Ltd., Batley. A sick pay scheme which offers increased security and prevents hardship in times of sickness has been introduced. Worked out in joint consultation with the works council and the directors, the scheme is designed to give maximum benefits to a majority of employees. Mr. T. V. Kean, chairman and managing director in announcing the adoption of the scheme said it was hoped it would be of real benefit, prevent hardship in times of sickness and give an increased feeling of security.

* * *

Chemstrand Area Office

Chemstrand Ltd. have now established an area office in Scotland at 38 Bath Street, Glasgow, C.2 (Tel. Douglas 5252). Mr. J. Huggan, sales manager for Scotland and Ireland, will be in charge of the office.

* * *

Anglo-Hungarian Trade Arrangement

Negotiations between the U.K. and Hungary have resulted in the signing of a new trade arrangement. Import quotas on both sides will be negotiated annually. Import quotas for 1960 allow for Hungarian imports of U.K. goods amounting to nearly £5½ million, including machinery, textile manufactures, chemicals, etc. During the same period the U.K. will issue licences for the import of Hungarian goods to a value of about £4½ million, including textiles and manufactures, etc.

* * *

Import Licensing

The functions of Import Licensing Branch have been transferred to the Tariff and Import Policy Division of the Board of Trade. All applications and inquiries relating to import licensing should now be addressed to Board of Trade, Tariff and Import Policy Division, Horse Guards Avenue, London, S.W.1.

* * *

Interesting Jacquard Development

John T. Hardaker Ltd., Bowling Iron Works, Bradford 4, announce that work is nearing completion on a revolutionary motion. Fitted to large capacity jacquard machines they say it will enable much higher speeds to be attained than has been previously possible. Full details will be released shortly.

Cotton Cheese Cloth

A new British Standard (B.S. 3196 : 1960) specifies minimum requirements for cotton cheese cloth, tubular woven cheese bandages and stiffened cheese caps suitable for bandaging material in the manufacture of cheese. The specification is based on cotton supplies currently in general use, a wide range of types of material is available; and the minimum requirements specified. Copies are available from the British Standards Institution, 2 Park Street, London, W.1 (price 4s.).

* * *

Scientific Instruments Exhibition in Russia

As a result of the report to the Council by the three-man delegation of the Scientific Instrument Manufacturers' Association of Great Britain, Sima House, Queen Anne Street, London, W.1, which went to Moscow at the beginning of November, and the support from 30 members of S.I.M.A., an exhibition of British scientific instruments will be held in Moscow from June 16 to 26, 1960.

* * *

European Economic Co-operation

The Commercial Library, a department of the Manchester Central Library, has recently issued the eighteenth reading list in the European Economic Co-operation series. Well over 100 items are listed, consisting of pertinent books and periodical articles culled from many British and foreign sources. This list furnishes a useful guide to facts, figures and opinions relating to recent economic developments in Europe. Copies are obtainable, free, on application.

* * *

Change of Address

In order to centralise design, sales and manufacturing departments under one roof, Mellor Bromley (Air Conditioning) Ltd. have now moved into larger premises at St. Saviours Road, Leicester (Tel.: Leic. 38161).

* * *

Wire Healds

A new company has been formed by three well-known wire heald makers—F. W. Carr and Son Ltd., Greenwood and Co. (Shipley) Ltd., and Jones Textilaties Ltd.—to pool their combined knowledge and concentrate production of wire healds in one works and market their products through one selling organisation. As a result, Wire Healds Ltd., 1 Booth Street, Manchester 2, say they can now produce every type of wire heald, including twisted eyes or inset eyes from the lightest to the heaviest gauges and in all depths. They can also produce any type of frame from light frames for silk weaving, with wood or light alloy staves, to the most robust frames for weaving mechanical cloths. In addition, they can knit wire healds for the widest range of fabrics.

ALL CARPET MANUFACTURERS

MACKIE

Invites you to see this Carpet Plant for yourself

We cordially invite all carpet manufacturers to visit our works at Belfast where a plant is in operation. You will be able to study the production process and discuss your own problems with our technical staff. Should you be unable to make a personal visit we should be pleased to process a sample of your material for your inspection.

SPECIAL FEATURES

A Regular Yarn.

Approx. 2-2½ times stronger than a woollen spun yarn of the same material.

Already proven to be the cheapest method of converting stock to yarn.

Suitable for Viscose, Acetate, High Crimped Nylon and Woollen Blends from 4·5-50 Deniers and 4"—8" staple and wool.

TEXTILE MACHINISTS
SINCE 1846

James Mackie & Sons Ltd

BELFAST
NORTHERN IRELAND

CARPETS

S 6.

Rapid Drying Synthetic Enamel

"Carltonian," an air drying "hammer finish" synthetic enamel announced by Waring Bros. and Co. Ltd., Bolton, is said to dry dust free in 30 mins. and can be handled in about 4 hours. Due to the thickness of the film it does not become, however, thoroughly rock hard until the next day. This drying process may be hastened by mild stoving treatment. It may be applied directly on to bare metal or other suitable surface.

The enamel is applied by spraying—any type of spray apparatus can be used. Spraying pressure 50 lbs./sq. in. It is supplied ready for use and should not be thinned or the "hammer effect" will be lost. The enamel has all the usual properties of a top quality machinery enamel, e.g. resistant to oil, petrol and heat. It also withstands the action of mild acids and alkalis, and has good outdoor durability. Available in a limited range of colours it should be particularly interesting to all concerned with maintenance in mills and factories, etc.

* * *

Wool Dyeing Process

The Irga-Solvent process for wool (Geigy) is a method (patent pending) of dyeing wool from a bath containing a solvent using low temperatures and relatively short dyeing times. The temperatures are of the order of 60 - 80°C. and the dyeing time about 30 mins. The solvent used is benzyl alcohol. As yet the technique is primarily confined to processing loose stock and slubbing. It is stated that the shorter dyeing time and lower temperature leave the material in generally better condition, also that the handle is better and shades brighter.

* * *

New B.D.A. Finish for Cottons

Bradford Dyers' Association Ltd. have developed a new finish called Prystene. With this finish cottons are said to dry smoothly and naturally free from creasing and to have a unique soft, silky handle. Additionally, the finish is fully shrunk, and is claimed to confer an extremely high abrasion resistance—particularly important in collars and cuffs. Patents have been applied for. The Prystene finish will be included within the Rigmel branded range of finishes. Garments made-up from Prystene finished cotton cloth shed dirt readily on washing and creases disappear. Prystene can be obtained within the price range of the normal Rigmel C-CL chlorine resistant finish.

* * *

Swiss Industries Fair

The Swiss Industries Fair, Switzerland's annual display of industry in Basle, will take place from April 23 to May 3, 1960. The display of products by some 2,300 exhibitors includes textiles, clothing, fashion goods, chemical products, machinery and accessories. Fuller particulars and copies of the catalogue are obtainable from Swiss Embassies, Legations, Consulates and Chambers of Commerce.

* * *

Change of Address

The Bristol branch office of Brook Motors Ltd. is now in larger premises. The address is Refuge Assurance Building, 18 Baldwin Street, Bristol 1.

Tweed Men "Dismayed" by U.S. Quota

President Eisenhower's announcement of the extension unchanged for a further year of the U.S. tariff quota on imported woollen cloth has dismayed Scottish tweed manufacturers who were hoping that renegotiation of the tariff could have been completed in time to operate this year, Mr. W. Dickson Smith (vice-president. National Association of Scottish Woollen Manufacturers) said, "Fewer than six weeks of the present year have gone by, yet half the quota of 13,500,000 lbs. has already entered the U.S. It means that for another year we are condemned to trading under quite artificial conditions. "It is this distortion of trade which hits the Scottish tweed industry because our exports to America are geared to fashion and seasonal demands. Our ability to take advantage of the very short period during which the quota is open is therefore restricted. The Japanese and Italians on the other hand, making cheap plain cloths, can pour in vast quantities of cloth directly competitive with what the Americans manufacture themselves. "We are hopeful that as a result of negotiations, the Americans will revise the present system shortly so that we in Scotland can compete on equal terms" said Mr. Smith. When the quota is filled, the tariff rises from 25% to 45% in addition to the normal duty of 37½ cents/lb.

* * *

Galashiels Firm Extends to Yorkshire

John Gladstone and Co. Ltd. the Galashiels firm of shrinkers announce that negotiations have been completed for the acquisition of the finishing section of Wellington Mills, Huddersfield, formerly owned by Martin, Sons and Co. Ltd. Mr. D. Finlay Maxwell (managing director John Gladstone and Co.), said some technical staff required would be trained in Galashiels. Specially designed electronic equipment is now being built, and production is expected to begin six to eight months time. Mr. Maxwell added that capacity would be built up by stages, and at its maximum would be about two and a half times that of the firm's existing capacity in Galashiels. It was hoped to employ about 150 people ultimately.

* * *

Uganda Buys Cloth in Spite of Boycott

In Uganda the sales of goods and services affected by the boycott of non-African traders have been below normal but retail trading conditions improved recently, says a Barclays Bank D.C.O. message from Kampala. Heavy quality nylon, mercerised, etc. drills and grey cloth have been in short supply but indents for Japanese piecegoods ordered in November and December should be coming forward soon. Import licences on Japan covering piecegoods valued at £410,000 were issued in Nov./Dec. compared with £235,000 in the corresponding period of 1958.

* * *

New Appointment

Mr. E. P. Collins (advertising manager, Morgan Crucible Co. Ltd. and its associate companies was recently elected hon. secretary of the Incorporated Advertising Managers Association. He has been a member of the Society for 13 years and was recently awarded a Fellowship for his services to advertising and to the Association.

T.I. Honours

The Textile Institute have awarded Fellowship diplomas to the following:—

R. C. Ghosh B.Sc., M.Sc., Ph.D.; Senior Scientific Officer, Govt. of India, I.G.S. Laboratories, Bombay, 1.

J. W. S. Hearle, Ph.D., M.A., A.Inst.P.; Senior Lecturer in Textile Technology, Manchester College of Science and Technology, Manchester 1.

B. B. Joshi, A.T.I., L.T.M., Director, New India Industries Ltd., Baroda, India.

J. B. Levy, B.Sc.Tech., M.Sc., M.A., Ph.D., A.M.C.T., A.T.I., Staff Assistant to general manager and president, Ducilo S.A.I.C., Buenos Aires, Argentina.

A. S. Ramadan, A.T.I.; Assistant Technical Expert, Council of Ministers, National Research Council, Cairo, Egypt.

* * *

New Appointments

British Celanese Ltd. announce that Mr. P. S. Rendall is to be chairman and Mr. C. F. Kearton O.B.E. deputy chairman whilst retaining his office as senior managing director.

* * *

Cotton Certification Trade Mark

In order to protect manufacturers, distributors, retailers and the public from any form of even unintentional misrepresentation, a new certification Trade Mark has been registered by the West Indian Sea Island Cotton Association. End products will only be entitled to bear this mark if each of the processors of and dealers in the cotton from spinner to ultimate manufacturer, converter or exporter have become authorised users of the mark and signed an agreement.

Labels bearing the mark will not only certify that the garments are made from West Indian Sea Island cotton but a colour scheme has been introduced by

means of which materials made of different qualities of yarn will be certified by coloured labels.

(1) A gold label indicates wholly two-fold or multi-fold yarn.

(2) A silver label is for materials made from partly single yarn and partly two-fold or multi-fold yarn, to an extent from time to time approved by the Committee.

(3) A bronze label denotes goods made from wholly single yarn.

The issue of labels is controlled by the Advisory Committee of the West Indian Sea Island Cotton Association, 452-453 Royal Exchange, Manchester 2, and issues are only made to correspond with the number of garments.

GUIDES THAT LAST A LIFETIME

STANDARD SINTOX ceramic thread guides save expense and give indefinite life.

This is one of the Cooke Creels at the Melbourne, Derbyshire factory of Thomas Haimes and Company Limited. For the processing of nylon yarn STANDARD SINTOX thread guides have been adopted.

The Creel takes 2,368 eyelets and 672 tubes. Whereas the cost of fitting this Creel with special SINTOX guides would have been £119, the adoption of items from the SINTOX STANDARD RANGE has meant a 55% reduction in expenditure . . . and SINTOX never wears out.

Technical advice on the application of SINTOX guides will be given without obligation by the selling Agents:—

Crabtree Textile Accessories, Colne, Lancs. Telephone Colne 985 & 499
or the manufacturers:—
LODGE PLUGS LIMITED, RUGBY, SINTOX DIVISION. Tel. Rugby 2076

SINTOX

CERAMIC THREAD GUIDES

T.1

HIGHER LOOM EFFICIENCY

IDENTICAL SHUTTLE REST POSITION

PRECISION SHUTTLE AND SMOOTH FLIGHT

THE
WILDT MELLOR BROMLEY
HYDRAULIC
LOOM BUFFER
(PATENTED)

WILDT MELLOR BROMLEY LTD.
(A Member of the Bentley Group)
DISRAELI STREET, AYLESTONE, LEICESTER, ENGLAND
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Telegrams: WILDT, Leicester, Telex

AVOIDS CONSTANT STRAP MAINTENANCE

IMPROVED FABRIC QUALITY

INCREASED SHUTTLE LIFE

RECENT TEXTILE PATENTS

These abridgements are republished from specifications by permission of the Controller of H.M. Stationery Office. The full specifications can be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2. Price 3s. each.

807,271 Selvedges on Shuttleless Looms

DUERKOPPWERKE AKT.GES, 2 *Nikolaus-Duerkoppstrasse, Bielefeld, Germany.*

A shuttleless loom comprises means for forming a pair of warp sheds, a pair of parallel weft-inserting needles each of which has an eyelet and a hook, and means for reciprocating the needles simultaneously so that one needle enters into and withdraws from each of the warp sheds. One needle is adapted to insert a thread passing through its eyelet into its respective shed on the shed-entering stroke of a reciprocation, the other needle being adapted then to receive the thread with its hook and to insert it by drawing it through its respective shed on the withdrawing stroke of the reciprocation.

807,310 Automatic Weft Replenishment

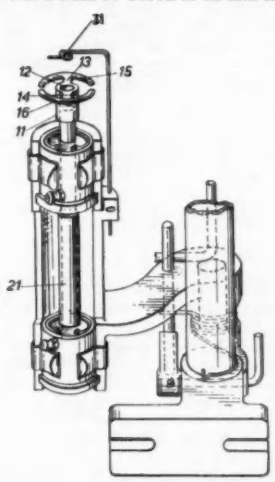
H. HELD, *Kramerstrasse* 49, *Reutlingen, Germany*, C. WAGNER, M. HELD, D. SCHAAL, M. MUMMENHOFF and A. GASSNER, trading as C. C. EGELHAAF.

A power loom has a weft cop ejector arranged to enter the shuttle and engage the waste thread. The ejector is arranged on the weft cop replacement side between the cop replacement device and the work, so as to eject the cop waste before the shuttle reaches its end position. In this way, it becomes possible for the ejection of the old weft cop and the introduction of the new weft cop to be carried out in the time from emergence of the shuttle from the fabric until its re-entry into the fabric, without a double weft ensuing.

807,318 Yarn Twister Heads

SYDNEY and E. SCRAGG LTD., *Oxford Road Works, Oxford Road, Macclesfield.*

Describes an improved twister head of a false-twisting device. The twister head comprises a boss 11 bored at 12 and having two arms 13 and 14 each terminating in a yarn retaining member 15 or 16. The members 15 and 16 lie between horizontal planes containing the upper and lower surfaces of the arms 13 and 14. The twister head is mounted at the upper end of a hollow spindle 21 driven by a belt (not shown). In use, a yarn engaged in a pigtail guide 31 is passed around one of the radial arms and its end is then inserted into the gore 12 and the yarn passed down through the hollow spindle 21.



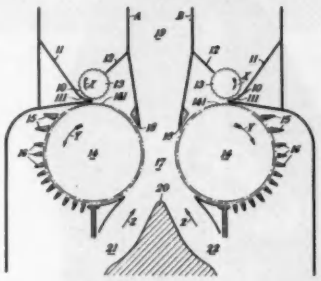
807,403 Pneumatic Picking on Looms

G. KUMMER, *Paradeplatz, Zurich, Switzerland.* A device for pneumatic picking motions on looms, comprises on both sides of the warp shed a cylinder connected to a source of compressed air and on which a cylinder actuable by compressed air is supported so as to be slidable thereon between two end positions. Each slidable cylinder is partitioned into two pressure chambers and each cylinder is provided with a lever mechanism which controls a valve arrangement associated with the pressure chambers for effecting picking motion through the cylinder actuable by compressed air.

807,515 Opening and Blending Fibres

T.M.M. (RESEARCH) LTD., *Hartford Works, Oldham.*

Improved machinery for opening and cleaning, and to the subsequent mixing and blending of fibres. Two vertical trunks A and B are arranged to be supplied with cotton from one or from two individual bale-breakers, the cotton falling down by gravity. At the base of each trunk is an outlet 10 governed by converging feed-plates 11, 12 and a fluted roller 13 being adapted to co-operate with a concave curved part 111 of the feed-plate 11 in delivering the material through the aperture of outlet 10 at a controlled rate in the form of a partially compacted sheet. Beneath each trunk outlet is a beater 14, similar to the taker-in of the carding machine, having a covering 141 of closely spaced saw tooth wire. The beater 14 is rotated at high speed and the tips of the teeth pass through the leading fringe of the fibres discharged from the trunk to progressively reduce the same by detaching individual small tufts. The tufts are carried round by the beater 14 past mote knives 15 and a trash grid 16 which surround a part of the beater periphery. The two beaters are separated by a single chamber 17 into which the fibres carried by both beaters are deposited. The removal of the fibres from the beaters is performed pneumatically, a suitably directed airstream being discharged tangentially in the direction of the arrow Z against the surface of each beater, and the stripping action is assisted by the knife-edge 18. Conveniently, a duct 19 leading from the chamber 17 is arranged to



convey the opened fibres to the next processing stage, the entry to the duct 19 being of divergent form. The stripping chamber 17 is bounded upon its lower side by a deflector 20, which separates two inclined air inlet ducts 21, 22 and serves to direct the two entering airstreams upon the beaters at the desired angle. The dimensions of the inlet ducts 21, 22, the chamber 17 and of the mouth of the outlet duct 19 are so relatively proportioned that a high-velocity airflow is created in chamber 17, by which the cleaned material is stripped from the surfaces of the cylinders and caused to be intimately mixed as it is conveyed through the outlet 19.

807,579 New Drafting Arrangement

VEB SPINNEREIMASCHINENBAU KARL-MARX-STADT, 27 *Altchemnitzer Strasse, Karl-Marx-Stadt, Germany.*

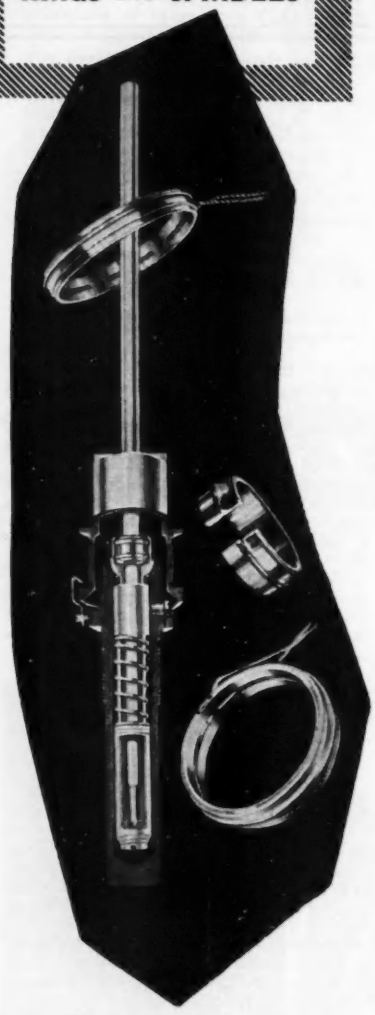
Improved drafting in which the material is drafted between two or more aprons and plates are disposed below the aprons. A common support arm is provided for the plates associated with the top aprons, the support arm being disposed below the drafting plane and mounted on a support bar along the machine behind the drafting frame. The plates are displaceable perpendicular to the drafting plane on guide means and are urged against the associated top aprons through loading means disposed below the drafting plane.

807,613 Weaver's Knot on Mechanical Knotter

MELLOR BROMLEY AND CO. LTD., *Minotaur Works, St. Saviour's Road East, Leicester.*

An improved form of weaver's knot which is generally more secure, but is easier to unite, than a conventional knot. The knot has four free extremities of yarn and a short, separate piece of the yarn from which the closed loop formation is formed, is wedged tightly in the open loop formation of the other yarn so as to enhance the security of the knot. This construction is achieved by drawing an additional loop of the yarn having the closed loop formation through the open loop formation or the other yarn, retaining this additional loop in the knot during tightening, so that parallel limbs of the additional loop are located in the tightened knot. After the

Arunco
RINGS and SPINDLES



For truly balanced running and long trouble-free life

ARUNDEL COULTHARD & CO LTD
PRESTON
Telephone Preston 3065 (Two lines)
Established 1815 Also at Stockport

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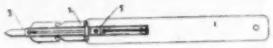
knot has been tightened, the portion of the additional loop which initially connects the limbs is severed and projects from the knot.

807,794 Drying Yarn Packages
LINEN THREAD CO. LTD., 95 *Bothwell Street, Glasgow, C.2.*

Apparatus for drying packages of yarn comprises a stationary hot air-supplying unit including a coupling, and a mobile unit in the form of a truck including a complementary coupling adapted for detachable air-receiving association with the first coupling, with conduit or chamber means for receiving the hot air. Air outlets are provided from the chamber and mountings carry the packages in obturating association with the outlets whereby the air is caused to flow out through the windings of the packages. The outlets may consist of hollow perforate spigots projecting out from the chamber and adapted to receive the usual perforated tubes and clamps may be provided for each spigot to retain the package in position, preferably by engaging and simultaneously closing the outer end of the tube.

807,864 New Reed Hook
H. F. J. WAREHAM, *Whetstone House, 50 Great North Road, Welwyn.*

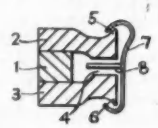
A reed hook for threading the reed in looms, which prevents eye strain and makes threading much quicker. The point of the sliding blade 3 is pressed into a reed dent and pressed home until the fixed blade 2 engages the lock 5 at the back of the sliding blade. The sliding blade will then be in one dent and the non-sliding blade in



another dent, sandwiching a reed wire or wires between the two blades, and the lock 5 will hold the two blades firm. A warp near its loose end is then passed over the hook of the blade 2, and while this blade is being withdrawn with the warp, the sliding blade 3 will automatically spring into the dent just about to be vacated by blade 2, and as soon as the point of blade 2 is just clear of the front of the reed it will spring sideways ready once more to press home and pick up the next warp.

807,964 Controlling Tension on Ringframes, etc.
COURTAULDS LTD., 16 *St. Martin's-le-Grand, London.*

Describes a ring and traveller for spinning and twisting machinery in which the ring is magnetised in the direction of



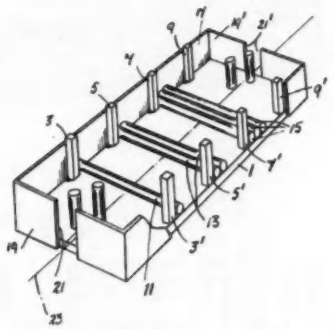
its axis and has an annular air gap into which an electrically conductive, non-magnetic vane on the traveller can project so that, in travelling round the ring, the traveller is subjected to eddy current braking. The ring consists of an annular magnet 1 which is magnetised so that its North pole is on the upper face and its South pole on the lower face. Upper and lower pole pieces 2, 3 of high permeability ferromagnetic material are secured to these two faces, and are shaped so as to define an air gap 4. Each pole piece has a rim 5, 6 respectively over which a traveller 7 may be clipped. The traveller 7 is provided with an electrically conductive non-magnetic vane 8 which projects into the air gap 4 when the traveller is in position. The traveller may be made of the same material as the vane, or may be of different non-magnetic material.

808,067 Yarn Waxing Device
THOMAS HOLT LTD., *Atlas Iron Works, Rochdale.*

An improved device for waxing yarns includes a dish-like member, a vertical spindle mounted in the basal member, and a waxing spindle mounted around the stationary spindle and furnished at its upper end with a block having a projecting peg adapted to fit a conical seating in the upper surface of the stationary spindle. A circular table is fitted around the lower part of the waxing spindle, and a star-wheel is also fitted around the waxing spindle below the table, and the waxing spindle, the table and the star-wheel form a revolvable integer. A wax disc is strung on the waxing spindle and rests on the table. An escapement lever pivotally mounted at one end on a peg in the floor of the balsa member, the escapement lever fitting between the head of the peg and a friction washer. The escapement lever is furnished on opposite sides with a tooth engageable with the teeth of the adjacent star-wheel and the distal end of the escapement lever is formed of such a mass as to provide the required tension on yarn passing through the waxing device.

808,133. Tensioning Device Applies Tension Gradually
BRITISH NYLON SPINNERS LTD., *Pontypool.*

Improved thread tensioning devices which is of particular importance when used for tensioning fine filament yarns, such as nylon. A device is described which when used on a machine for coning thread is capable of maintaining a steady output tension of 3 grams on 30 denier 10 filament nylon yarn throughout the winding of a 1 lb. cone. The device comprises a flat sintered alumina bottom plate 1, carrying four pairs of upright spacing pins $3,3^1$, $5,5^1$, $7,7^1$ and $9,9^1$ between which are laid



cylinders of sintered alumina all of $\frac{1}{4}$ in. diameter and $\frac{1}{2}$ in. in length and all having their axes normal to the direction of travel of the yarn, which travels from left to right. Between the first and second pairs of spacing pins is laid a cylinder 11; between the second and third are laid 2 cylinders 13 and between the third and fourth are laid 3 cylinders 15. Rectangular-shaped side and end walls 17, 19 (19^1) of metal are secured to the bottom plate, to prevent any

axial movement of the cylinders and the walls are provided with apertures 21, 21^1 for passage of yarn 23 between the cylinders and the plate 1.

808,212. Card Construction for Experimental Purposes

T.M.M. (RESEARCH) LTD., *Hartford Works, Oldham.*

An alternative form of carding machine which will be suitable for experiment, in which normal operating conditions and results can be reproduced, and which will permit an unobstructed inspection of the effect of the processes upon the material at intermediate stages. A construction is provided in which the processing elements are supported in operating condition solely by a frame, so that they all extend forwardly of one side of it, means being provided behind side of the frame for imparting requisite motion to the elements. Means are provided to give a wide range of adjustment of position and relative speeds of some of all of the elements.

808,254 Spindle Tapes

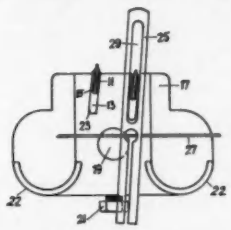
CELANESE CORPORATION OF AMERICA, 180 *Madison Avenue, New York* 16, *U.S.A.*

A spindle tape comprises a woven cellulose fabric impregnated with a resinous copolymer of at least 50% of vinyl acetate and correspondingly at least 5% of another mono-ethylenically unsaturated ester of a carboxylic acid. In one example, a twill-woven cotton spindle tape, $1\frac{1}{4}$ ins. wide, about 0·038 in. thick, and 11 ft. long, and having its ends overlapped by 12 ins. and spliced with nylon sewing thread, to form an endless band, is impregnated by dipping it into a bath of a latex at room temperature comprising 53% of a binary copolymer of 20% of di-*n*-butyl fumarate and 80% of vinyl acetate; 44% of water; 0·6% of "Cellosize WP—09" (comprising hydroxyethyl cellulose); and the balance comprising surface active agents including sodium dodecyl benzene sulphonate and water-insoluble condensates of polyethylene oxide and polypropylene oxide. The copolymer has a molecular weight of 20,000 to 24,000. After dipping, the fabric is dried in air to produce a product containing 60% of its weight of the copolymer. The tape, which shrinks 8% - 10% during impregnation and drying, is then stretched back to its original length. Tapes produced in this manner have been employed in winding and twisting machines and after 200 to 250 days, representing 4,800 to 6,000 hours of effective operation, the tapes are removed from the machines. In contrast, unimpregnated but otherwise identical cotton tapes have failed after an average of 102 days of operation.

808,359 Loom Warp Stop Motions

GRAHAM BRACEWELL LTD., *Fountain Street Works, Nelson.*

Describes a method of supporting a contact bar or bars for an electrical warp stop motion of a loom. Each contact bar has an inner contact strip 11 and an outer strip 13 which extends around the lower edge of strip 11 and forms contact faces on both sides. The two strips are insulated by a layer 15 of insulating material. Brackets 17 are provided at each end of the loom, and are adapted to be secured to a bar forming part of the loom frame by the hole 19 and setscrew 21, and semi-circular lips 22 engage with warp tension rods to locate the brackets in the correct position. Two slots 23 are formed in each bracket to receive the contact bars, and the



slots are inclined so that when the stop motion is fixed to the loom the contact bars are inclined at an angle of 6° to the vertical. The drop pins 25 are threaded on to their respective contact bars which are then fixed in place in the brackets on the loom. Each drop pin is supported by its respective warp thread 27. The strip 13 is connected to earth potential and the strip 11 is connected to a source of electrical supply and forms part of the loom stop motion circuit. When a warp thread breaks, the drop pin 25 falls and the upper end of the pin makes contact with the strip 11 whilst one side of the slot 29 makes contact with the upward facing surface of the strip 13 thereby closing the stop motion circuit and bringing the loom to rest.

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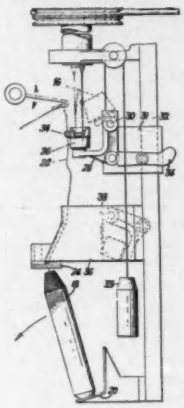

yarn. At the open end of the spindle, there is a buttress 26 carried by a bracket 28 mounted on a bracket 31. The bracket is arranged to slide on a part 32 of the frame and is urged upwards by a counterweight 33. The buttress comprises a rotary cup which, during normal operation of the machine is pressed against the lower end of the cop. The bracket 28 is prevented from swinging about its pivot 30 by a stop 34 mounted on the bracket 31. The outside of the cup is provided with a number of spurs 34 which, on rotation of the buttress pick up the yarn and cause it to be wound on to the spindle. As the cop grows, the bracket 28 is pushed downwards until the cop is of the desired length. The stop member 34 is then swung (by means not shown) on its pivot so that bracket 28 swings into the position shown in broken lines, in which the buttress is clear of the spindle and the cop. The cone then descends and strips the cop. In order to steady the cop during its descent, a tube 36 is provided which is slotted at 38 to allow the buttress to move past it.

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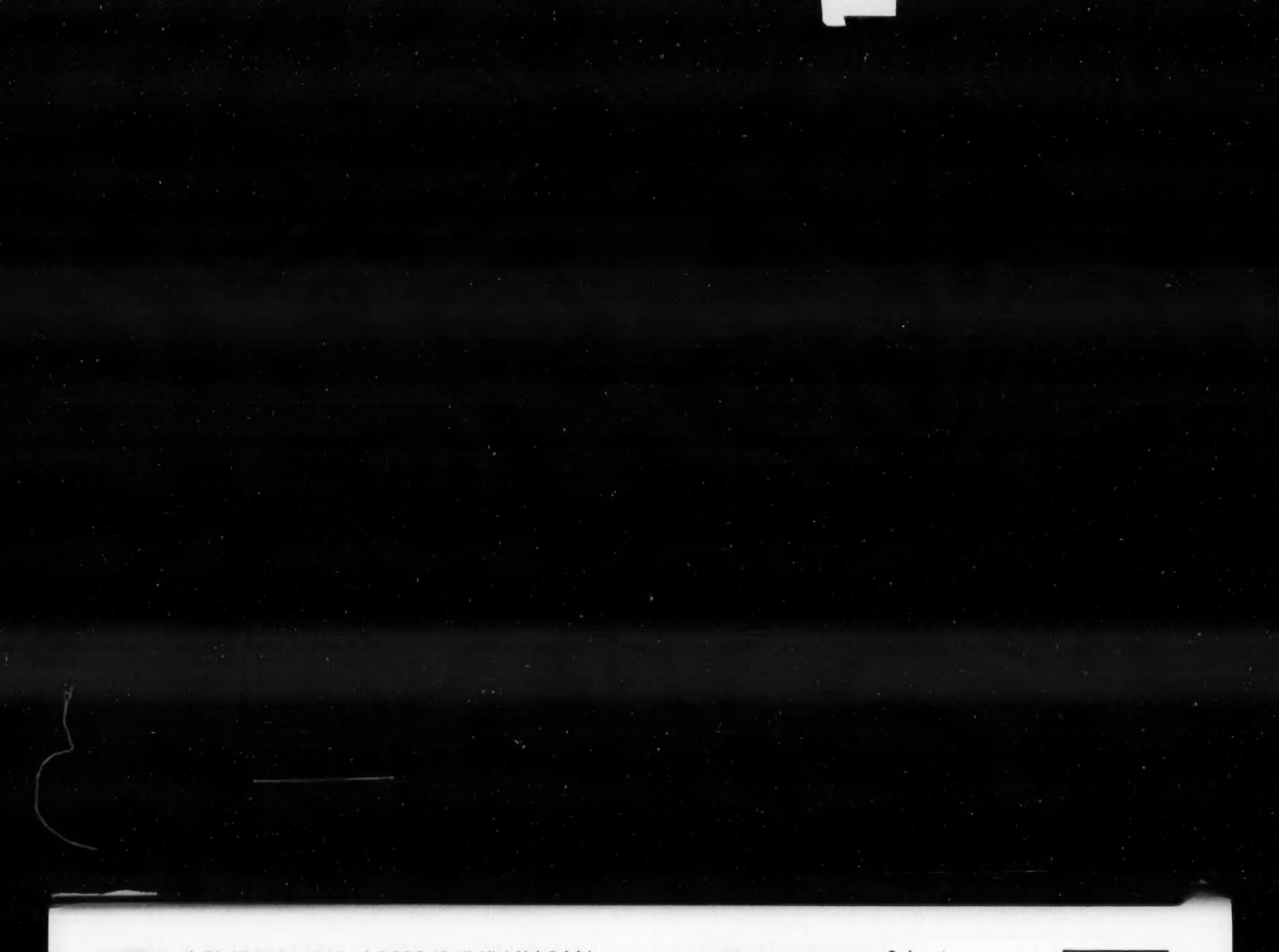
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